Microbiological Observations in South Davis Strait

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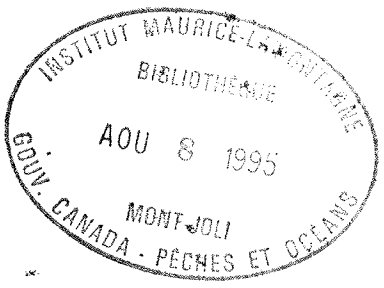

Microbiological observations in south Davis Strait

First report to the Eastern Arctic Marine Environmental Studies (EAMES) project

by

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DISCLAIMER

The data for this report were obtained as a result of investigations carried out under the Eastern Arctic Marine Environmental Studies (EAMES) program, sponsored by the Department of Indian Affairs and Northern Development (DIAND) to provide information necessary for the assessment of oil drilling proposals. Financial support was provided by DIAND, Esso Resources Canada Ltd., Aquitaine Co. of Canada Ltd. and Canada Cities Services Ltd.

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ABSTRACT

Bunch, J. N. 1979. Microbiological observations in south Davis Strait. Fish. Mar. Serv. MS Rep. 1515: x + 92 p.

Microbiological observations were made during three cruises on Davis Strait in April-May 1977, April 1978 and August 1978. Total numbers of bacterial cells, total viable heterotrophs, numbers of oleoclastic bacteria, potential heterotrophic activity, mineralization of hexadecane and concentrations of particulate and dissolved organic carbon were determined from occupied stations. Simultaneous observations of temperature, salinity, reactive nitrate and phosphate, phytoplankton numbers and chlorophyll a were made by MacLaren Marex Inc.

Total numbers of bacteria, as determined by a direct count procedure, were found to increase approximately one order of magnitude between spring and summer observations. A similar average increase was observed in the numbers of oleoclastic cells. It was concluded that these increases were in response to the spring bloom of phytoplankton. Profile stations demonstrated a ten-fold decrease in bacterial numbers from one to 200 metres depth.

Values of potential heterotrophic bacterial activity (or Vmax), as measured by the incorporation or uptake of ^{14}C-glutamic acid, were found to vary with the state of the phytoplankton bloom. During the spring cruises, stations in a bloom condition were found to have an average bacterial Vmax approximately one order of magnitude higher than stations which were considered to be in a "prebloom" or winter condition.

Station occupations at similar locations in August demonstrated an average Vmax approximately two to four times lower than during the spring bloom, in spite of a ten-fold increase in bacterial numbers. This was interpreted to mean that the bacterial flora had exhausted dissolved organic nutrients produced by phytoplankton, specifically glutamic acid substrate. The Vmax of potential heterotrophic activity at 200 metres depth was uniformly low during spring and summer observations.

Mineralization of hexadecane was determined by the measurement of $^{14}CO_2$ evolved by seawater samples supplemented with Norman Wells crude petroleum and ^{14}C-hexadecane. Although the numbers of petroleum-degrading bacteria or oleoclasts capable of utilizing this substrate increased ten-fold between spring and summer, the amount of hexadecane mineralization observed during April 1978 was 7.8 times higher than that measured in August water samples. It was concluded that hexadecane mineralization was limited by the concentrations of nutrients, particularly reactive nitrate, present in the waters sampled. It is suggested that petroleum resulting from blowouts during the drilling season in south Davis Strait will not be degraded to any extent until the following year when nutrients have been replenished in surface waters.

Key words: bacteria, heterotrophic potential, oleoclast, biodegradation, phytoplankton, season, Davis Strait, carbon, mineralization, petroleum.

RESUME

Bunch, J. N. 1979. Microbiological observations in south Davis Strait. Fish. Mar. Serv. MS Rep. 1515: x + 92 p.

Des observations d'ordre microbiologique ont été faites lors de trois croisières effectuées dans le Détroit de Davis en avril-mai 1977, avril 1978 et août 1978. Le nombre total de cellules bactériennes, d'hétérotrophes viables, de bactéries oléoclastes, l'activité hétérotrophe potentielle, la minéralisation de l'hexadécane et les concentrations de carbone organique dissout et particulaire ont été déterminés pour toutes les stations occupées. Simultanément, des observations concernant la température, la salinité, les nitrates et phosphates réactifs, la quantité de phytoplancton et de chlorophylle a ont été faites par MacLaren Marex Inc.

Le nombre total de bactéries, déterminé par la méthode du comptage direct, a augmenté d'un ordre de grandeur environ entre le printemps et l'été. Une augmentation moyenne semblable a été observée dans le cas des cellules oléoclastes. Ces augmentations concordent avec le bloom phytoplanctonique du printemps. Les stations où des profils ont été effectués montrent une baisse du nombre de bactéries de l'ordre de 10 entre 1 et 200 mètres de profondeur.

Des valeurs de l'activité potentielle de bactéries hétérotrophes (Vmax), mesurées par l'incorporation de l'acide glutamique-^{14}C, varient selon l'état du bloom phytoplanctonique. Durant les croisières effectuées au printemps, les stations en état de bloom avaient un Vmax moyen, pour les bactéries, d'environ un ordre de grandeur supérieur à celui observé aux stations en état de "prébloom" ou conditions d'hiver.

L'occupation des stations à des emplacements similaires en août a démontré que le Vmax moyen était environ 2 à 4 fois moins élevé durant le bloom du printemps et ce, en dépit d'un décuplement du nombre de bactéries. Ceci a été interprété par le fait que la flore bactérienne ait épuisé la matière organique dissoute produite par le phytoplancton, spécialement l'acide glutamique en tant que substrat. Le Vmax de l'activité hétérotrophe potentielle est demeuré faible à 200 mètres de profondeur tout au long des observations faites au printemps et en été.

La minéralisation de l'hexadécane a été déterminée en mesurant la quantité de $^{14}CO_2$ dégagée par les échantillons d'eau de mer, enrichis de pétrole brut Norman Wells et d'hexadécane-^{14}C. Bien que le nombre de bactéries, aptes à dégrader le pétrole, ou d'oléoclastes, capables d'utiliser ce substrat, augmente de l'ordre de 10 entre le printemps et l'été, la quantité d'hexadécane minéralisé, observée durant avril 1978, était 7.8 fois supérieure à celle mesurée dans les échantillons d'eau pris en août. On a conclu que la minéralisation de l'hexadécane était limitée par la concentration des éléments nutritifs, plus spécialement les nitrates réactifs, présents dans l'eau échantillonnée. On estime que le pétrole provenant de l'éclatement d'un puits durant la saison de forage dans la partie sud du Détroit de Davis ne pourra être dégradé que l'année suivante lorsque les éléments nutritifs auront été renouvelés dans les eaux de surface.

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Sincere thanks are extended to the people who are directly involved in this large study and are continuing in the many data analyses. R. Harland very capably directed the cruise logistics and procedures and contributed to the data analyses. T. Cartier, B. Chabot, P. Cejka, C. Grohe, L. McDuff and B. Petolas provided valuable technical support.

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1.0 INTRODUCTION

Microorganisms, including bacteria, yeasts, other fungi and phytoplankton are vital components of the world's oceans. Carbon is fixed and utilized by phytoplankton to form foragable biomass and dissolved organic nutrients for the marine food chain. Heterotrophic bacteria, through a process of oxidation, decompose complex organic molecules to smaller monomolecular units for incorporation into their protoplasm, thereby grazing the greater part of the dissolved organic nutrients formed by phytoplankton. In so doing, particulate bacterial biomass is made available for grazing by organisms at other trophic levels, and essential nutrients such as ammonia and phosphate are released by mineralization for re-entry into nutrient cycles. Bacterial floras have been estimated to comprise upwards of 50% of the biomass of the world's oceans (Morita, 1977) and therefore are important marine constituents in terms of both size and function.

The heterotrophic activity of bacteria is the concern of this report. The measurement of this process was first suggested by Parsons and Strickland (1962) and the technique was refined by Wright and Hobbie (1966). Further modifications were made by Hobbie and Crawford (1969) and by Harrison, Wright and Morita (1971). The method of heterotrophic potential is the sole technique available to evaluate the physiological state of bacteria in a water mass. Since the role of bacteria is so important in the cycling of carbon, knowledge of the ability of an indigenous bacterial flora to utilize a particular substrate in various locations and in different seasons should provide insight into the biological processes of the sea.

Glutamic acid, a dicarboxylic amino acid consisting of five carbon atoms, forms a component of the dissolved organic carbon in the marine ecosystem (Andrews and Williams, 1971). It is readily assimilated and mineralized by marine bacteria and for this reason has been used by several investigators as a substrate in the method of heterotrophic potential (Carney and Colwell, 1976; Morita, Griffiths and Hayasaka, 1977; Griffiths, Hayasaka, McNamara and Morita, 1978). Observations made with this technique are presented in this report and are the first observations of heterotrophic potentials in the North Atlantic.

Petroleum introduced to the marine ecosystem forms a highly complex part of the dissolved and particulate organic material in the water. Heterotrophic activity by bacteria and fungi comprises the sole route for the cycling of petroleum as part of the overall function of carbon-cycling. This is an oxidative biological process which requires a source of nitrogen, phosphorus, oxygen and trace elements and is subject to the constraints of temperature. The degradation and mineralization of petroleum hydrocarbons releases carbon and energy for the maintenance, growth and multiplication of some heterotrophic marine bacteria.

It is unlikely that these bacteria utilize petroleum hydrocarbons preferentially over dissolved organic material such as simple triglycerides,

other lipids, sugars and amino acids, and more complex peptides and polysaccharides. Moreover, where petroleum is degraded by bacteria, only the saturated unbranched alkane fraction is readily utilized, leaving a residue of complex aromatics and asphaltenes which is only slowly degraded.

The use of ^{14}C-labelled alkanes to measure the incorporation of this petroleum fraction into bacteria is relatively new. Some success was reported by Jordan, Hobbie and Peterson (1978) and Horowitz, Sexstone and Atlas (1978) but there are a number of problems inherent in the technique. Chief among these has been the inability to measure the actual amount of the labelled substance incorporated. Difficulties exist in separating the free radioactive substrate from the bacterial cells. At the present time, only that amount which has passed through the metabolic machinery of the cell and has been evolved as ^{14}C-carbon dioxide can be measured. Further difficulties have been encountered in our laboratory in determining the efficiency of the scintillation counting procedure. Because of these difficulties, any values for rates of degradation of a ^{14}C-labelled alkane must necessarily be underestimates. Some experimental work remains before this promising technique can be used to measure actual degradation rates of alkane fractions in particular, and other petroleum residues in general. The results reported here are the first obtained from a three-year study which is employing the technique in the evaluation of degradation potentials of various water bodies. It is anticipated that the technique will also be useful in enumerating the numbers of petroleum-degrading bacteria or oleoclasts present in a water mass, and in evaluating the effectiveness of chemical dispersants.

2.0 STUDY AREA

Microbiological collections were made and experiments conducted during three cruises in Davis Strait during the spring and summer seasons. The M.V. Lady Johnson II, chartered by Esso Resources Canada Ltd., departed from St. John's, Newfoundland, and occupied accurate stations in Davis Strait by means of satellite navigation. During these and other cruises between 1976 and 1978 large amounts of chemical, physical and biological data were obtained by MacLaren Marex Inc. The microbiological study was integrated into the cruise logistics of MacLaren Marex Inc. for three cruises, or portions thereof, and various observations and collections were made simultaneously. Samples were processed aboard the vessel in specially constructed laboratory facilities.

Throughout this report, the cruise numbers referred to are those of MacLaren Marex Inc. and complete descriptions and analyses of their data can be found in their cruise reports (MacLaren Atlantic Ltd., 1978; MacLaren Marex Inc., 1979a, 1979b). Cruise 77-2 was conducted during April-May 1977 (Fig. 1), cruise 78-1 during April 1978 (Fig. 2), and cruise 78-2 during August 1978 (Fig. 3).

The approximate ice fronts encountered on the spring cruises are denoted by the most western and northern stations occupied. In some instances, however, the vessel was able to penetrate safely up to 25 nautical miles into the pack ice. During the August 1978 cruise, no pack ice was observed and complete transects were accomplished. Depending on ice conditions, refuelling and changes of personnel were made at Frobisher Bay, N.W.T. or Godthaab, Greenland.

3.0 METHODS AND MATERIALS

3.1 Sampling Procedure

Water samples from depths of 1, 5, 20, 50, 100 and 200 metres were collected aseptically with Niskin SS1.5 sterile bag-samplers for microbiological purposes and with 5L Niskin bottle samplers for carbon analyses. The water samples were processed immediately after collection.

3.2 Plating Procedure

A spin-plate technique was employed to dispense an aliquot of the water sample on the surface of a cold agar plate with a cold pipette. Incubation was at 2.0°C for three weeks. Quadruplicate spin-plates were made of each water sample. After incubation, the plates were examined and those with an uneven distribution of colonies were discarded. The colonies of three plates of a replicate set were enumerated, averaged, and the mean value was expressed as a log number of total viable heterotrophs (TVH) per litre of water sample.

A modified formulation of the lib X agar medium of Griffiths, Hanus and Morita (1974) was prepared in advance of cruises and stored at 2.0°C until used. The medium consisted of 2.3 g trypticase (Baltimore Biological Laboratories), 1.2 g Bacto-yeast extract (Difco), 7.69 g Tris buffer (Trizma-7.2; Sigma Chemical Co.), 0.3 g sodium citrate, 0.3 g L-glutamic acid, 0.05 g sodium nitrate, 0.001 g ferric chloride, and 12.0 g Bacto-agar (Difco). The ingredients were dissolved in 1.0 L of 34°/$_{oo}$ Instant Ocean (Aquarium Systems, Inc.). The medium was autoclaved, cooled and dispensed in 100 mm petri dishes. Final pH at 5.0°C was 7.8.

3.3 Determination of Oleoclastic Cells

The abundance of oleoclasts was determined by the most probable number (MPN) procedure (American Public Health Association, 1971). Ten mL samples of seawater were added to 90 mL of sterile Instant Ocean (34°/$_{oo}$) in screw-cap dilution bottles and ten-fold serial dilutions up to 10^{-6} were prepared in triplicate. The bottles were supplemented with 100 mg of sterile, weathered Norman Wells crude petroleum.

3.4 Direct Count Procedure

Direct counts of bacteria in seawater were made using a procedure slightly modified from that described by Watson, Novitsky, Quinby and Valois (1977). Polycarbonate membrane filters (Nucleopore Corp.) of pore size 0.2 µm and 25 mm diameter were prestained in a 0.2% solution of irgalan black in 2% by volume acetic acid. The filter was then rinsed in cell-free distilled water and placed on a 25 mm glass filter holder (Millipore Corp.). A seawater sample of 2.0 to 10.0 mL, fixed at the time of collection with 0.2% gluteraldehyde, was added to the filter funnel after shaking in a vortex mixer, and sufficient acridine orange

(80% dye content) at a concentration of 0.1% in 0.02 mol Tris (pH 7.2) was added to the sample to yield a final stain concentration of 0.02%. After two minutes, the sample was filtered and the membrane was placed on a glass slide, wetted with a drop of Cargille Type A immersion oil and covered with a cover glass.

A Zeiss model WL microscope equipped with an epifluorescent condenser, a 50 watt mercury lamp, a BG 12 excitation filter, a No. 50 barrier filter, and a No. 500 beam splitter was used to view and count the cells. For counting, a 10 mm square reticule grid was used. A sufficient amount of seawater sample was filtered to yield about 100 cells per grid field. Ten randomly selected grid fields of each sample membrane were counted and the result was averaged and expressed as log number of cells per litre of seawater sample.

3.5 Phytoplankton, and Chemical and Physical Oceanography

Determinations of temperature, salinity, reactive phosphate and nitrate, chlorophyll a and phytoplankton numbers were made by MacLaren Marex Inc. A complete description of the procedures employed can be found in their cruise reports.

3.6 Bacterial Heterotrophic Potentials

An extensively modified procedure of that described by Harrison et al. (1971) was employed throughout this study. Aseptic water samples were collected, as previously described, and processed immediately. To measure substrate assimilated and retained by bacteria, ten mL aliquots of sample water were added to sixteen chilled and sterile 50 mL screw-cap bottles containing varying amounts of glutamic acid substrate. The vessels had previously been supplemented with glutamic acid, both labelled and unlabelled, such that, upon addition of the seawater, eight pairs of vessels contained one of eight concentrations of glutamic acid from one to 100 µg/L with 2.0 or 20.0 µCi/L of activity. The specific activity of the several lots of L-glutamic acid-U-^{14}C (New England Nuclear Corp.) used was approximately 230 mCi/mmol. A seventeenth vessel containing 100 µg/L of glutamic acid with 20 µCi/L of activity served as a background control for the eight concentrations. Upon addition of the seawater aliquot, the reaction volume of the control vessel was immediately filtered through a 25.0 mm membrane filter (Millipore Corp.) with a pore size of 0.45 µm and rinsed twice with 20.0 mL portions of cold, filtered seawater. The sixteen incubation vessels were held at 2.0°C for 9, 12 or 18 hours. This incubation temperature was judged to be sufficiently close to the *in situ* temperature in most cases. Incubation was stopped by simultaneous filtration of the sixteen vessels followed by cold rinsing. Rinsed membranes were transferred to scintillation vials containing 8.0 mL of Aquafluor (New England Nuclear Corp.), a dioxane-based fluor, as suggested by Thompson and Hamilton (1974).

To measure substrate respired by bacteria, seventeen 50 mL serum bottles were prepared with substrate and sample water as above. Upon addition of the

seawater sample to the control vessel, 0.2 mL of 5.0 N H_2SO_4 was immediately added to reduce the pH of the sample to below 2.0. Bottles were stoppered with serum caps fitted with a plastic reaction well (Kontes Glass Co.). The wells, suspended above the seawater sample, contained a fluted wick consisting of two glass filters (Whatman GFA-24 mm).

After incubation, the reaction in serum vessels was stopped by the addition of H_2SO_4 through the rubber caps by means of a syringe. At the same time, 0.2 mL of β-phenethylamine (New England Nuclear Corp.) was added through the cap into the plastic well where it was completely absorbed by the glass filters. The bottles were then further incubated for twelve hours at 40.0°C, during which time $^{14}CO_2$ in the reaction vessel was evolved from the seawater and absorbed by the phenethylamine-soaked wicks. The bottles were then opened and wicks were transferred to scintillation vials containing 8.0 mL of Aquasol (New England Nuclear Corp.).

Scintillation vials were transported to Ste-Anne-de-Bellevue where they were counted in a Nuclear-Chicago Isocap 300 scintillation counter. Quenching was corrected by the channel ratios method. Results of membrane and wick counts were combined to yield total uptake of the glutamic acid substrate. Uptake kinetics were generated by computer programs.

3.6.1 Theory

Kinetic parameters from the uptake of the glutamic acid substrate were calculated from a modified Michaelis-Menten equation (Dowd and Riggs, 1965) or

$$\frac{D\mu t}{d} = \frac{(K+S)}{Vmax} + \frac{A}{Vmax}$$

where $D\mu$ = radioactivity added, d = radioactivity taken up, t = incubation time in hours, K = an uptake constant, S = concentration of the natural substrate, Vmax = the maximum velocity of uptake, and A = concentration of the substrate added. Plotting $(\frac{D\mu t}{d})$ against A yields a straight line where the reciprocal of the slope = Vmax, y intercept = turnover time in hours (T), and x intercept = (K+S).

The maximum velocity (Vmax), or potential of heterotrophic activity, is the velocity of uptake at which the substrate saturates the uptake system such that the velocity can no longer increase. Vmax is an indication of the physiological state of the bacterial flora in that it demonstrates the potential ability of the flora to use a particular substrate, i.e. its degree of adaptedness to that substrate.

The value of (K+S) represents a combined value of the uptake constant and the concentration of the naturally-occurring substrate in the water

sampled. In a general way K may be considered as an affinity constant between cell and substrate. Specifically, it is the concentration of substrate required to drive the reaction at half-maximal. A high value of (K+S) may suggest an unadapted population or a high concentration of natural substrate, while a very low value indicates an adapted population or a low value of natural substrate. Turnover (T) is the time required for the flora to deplete all the available natural substrate in a litre of the water sample. A very large value of T suggests a high concentration of natural substrate being consumed at a low velocity by an unadapted flora. A very low value of T suggests a highly adapted flora rapidly consuming a low concentration of natural substrate.

In addition to the above kinetic parameters, uptake and assimilation of a radioactive amino acid denotes conversion of dissolved organic carbon to particulate bacterial biomass (i.e. growth and multiplication). Measurement of released $^{14}CO_2$ provides an estimate of mineralization of an amino acid substrate to CO_2 and ammonia.

3.7 Determination of Mineralization of Hexadecane

Three hundred mL aliquots of freshly-collected seawater were added to eight 500 mL sterile serum bottles supplemented with 300 µL of sterile weathered Norman Wells crude and 30 µL of hexadecane containing hexadecane -1-^{14}C (Amersham Corp.) with 0.3 µCi of radioactivity. A ninth bottle was immediately acidified to pH 2.0 with 6.0 mL of 5N H_2SO_4 and served as a background control. All vessels were incubated at 2.0°C and, at four or five day intervals, up to 16 or 20 days, two bottles were acidified.

In Ste-Anne-de-Bellevue, the vessels were purged of CO_2 which was collected in NaOH and precipitated with $BaCl_2$. The precipitates were filtered through 25.0 mm Whatman GFC filters and the filters added to scintillation vials containing 10.0 mL of Aquasol. Vials were counted and corrected for quenching with an internal standard.

3.8 Carbon Analyses

Carbon analyses were done by a procedure which modified and integrated the procedures of Menzel and Vaccaro (1964) and Stainton (1973). Freshly-collected 100 mL water samples were filtered through previously ashed Whatman GFC-25 mm glass filters. Filters and filtrates were immediately frozen for subsequent analysis.

Dissolved organic carbon (DOC) was determined from the thawed filtrate by wet oxidation in a sealed glass ampule after removal of inorganic carbonate. Particulate organic carbon (POC) was determined from thawed glass filters in a similar fashion. In both cases, evolved CO_2 was reduced to methane on a nickel catalyst in a continuous stream of hydrogen. Production of methane was determined by flame ionization using a Hewlett-Packard 5700A gas chromatograph and a Hewlett-Packard 3380 recorder-integrator.

4.0 RESULTS AND DISCUSSION

The three cruises undertaken in 1977 and 1978 successfully covered the region of south Davis Strait and included some areas likely to be affected by petroleum, should a blow-out occur. Comparison of the microbiological observations taken during the spring season of the two years with the observations of the August 1978 cruise provides a seasonal pattern of the distribution and activities of the indigenous bacterial flora. Together with the accumulated information of several cruises conducted by MacLaren Marex Inc., such data provide a reasonable baseline of microbiological information of Davis Strait waters.

The volume of data generated in the past year cannot be fully treated in this initial report. A second report will present observations made at inshore localities in Frobisher Bay in the past year. Most offshore observations will be interpreted on the basis of conclusions made from intensive site-specific sampling in Frobisher Bay. The study is to continue for two years and this report should be considered as a data report with some general and preliminary conclusions.

4.1 Physical and Chemical Oceanography

Observations of temperature, salinity and nutrients at stations occupied are seen in Tables 4, 5 and 6 and are provided for the reader's reference. The observations were made simultaneously with microbiological sampling. Treatment of these data can be found in the cruise reports of MacLaren Marex Inc. for cruises 77-2, 78-1 and 78-2.

4.2 Phytoplankton, and Dissolved and Particulate Carbon

Observations of phytoplankton numbers and concentrations of chlorophyll a in the waters sampled are to be found in Tables 7, 8 and 9. Again, these observations were made simultaneously with microbiological sampling. Treatment of these data, together with species composition of phytoplankton are to be found in the MacLaren Marex Inc. cruise reports. Figures 4, 5 and 6 show the numbers of phytoplankton observed in one metre water at all stations occupied during the three cruises.

During the spring cruise of 1977 (cruise 77-2), phytoplankton blooms were observed from the northeast of the cruise area down to latitude 62°N. Below this latitude, concentrations of phytoplankton were found along the ice edge at the most westerly stations. Cell numbers ranged as high as 3.3×10^6/L at stations where an intense bloom was in progress and nutrients were depleted. At these stations, the bloom was predominately in the top twenty metres of the water column, but occasionally extended down to a depth of 50 metres. Other stations such as 62, 63 and 46 in the southeast of the cruise area were low in phytoplankton numbers and nutrient levels were high. Such stations were considered to be in "prebloom" or winter condition.

During the cruise of April 1978 (78-1), which took place several weeks earlier than the cruise of 1977, phytoplankton blooms were detected north of latitude 62°N. Below this latitude there was little evidence of phytoplankton, and nutrients were uniformly high throughout the water columns sampled. MacLaren Marex Inc. (1979a) reported phytoplankton blooms throughout this region in the following month of May.

The summer cruise of August 1978 (cruise 78-2) demonstrated that most upper water layers between latitudes 60°N and 66°N were essentially depleted of nutrients. Phytoplankton blooms were observed only at latitude 66°N and along the Baffin coast where physical data suggested upwelling and replenishment of nutrients for phytoplankton development (MacLaren Marex Inc., 1979b).

Concentrations of dissolved and particulate organic carbon (DOC and POC respectively) were determined from all stations and are presented in Tables 4, 5 and 6. These values will be related to the activity of phytoplankton and bacteria in a later report.

4.3 Bacterial Numbers

The numbers of bacteria fluctuated both seasonally and spatially as might be expected, the degree of fluctuation being dependent on the state of the water mass and the technique employed for enumeration. The direct count procedure (see section 3.4), a relatively new technique, accurately counts all bacterial cells, both living and dead, in a water sample. Values of total viable heterotrophs (TVH) are obtained from plate counts and are an expression of the bacteria which are capable of multiplication on the cultivation medium employed. Counts obtained in this manner are generally several orders of magnitude lower than those obtained by direct count. This is not an indication that most of the flora is dead but rather that the cultivation medium will not support the multiplication of much of the bacterial flora present in the water sample. In addition, clumped bacterial cells are counted as a single unit on the cultivation medium and the actual count is therefore depressed.

The most probable number (MPN) procedure used in this study is a dilution to extinction method which cultivates those cells capable of multiplication in a medium containing weathered crude petroleum as a sole source of carbon. Enumeration of oil-degrading bacteria or oleoclasts in this fashion is rather imprecise but the technique is the best one available at this time.

The direct counts obtained from two cruises are seen in Tables 8 and 9. In almost all cases, profiles to 200 metres were made. No data are available from the spring cruise of 1977. In 1978, direct counts of bacteria in April ranged from a low of 7.9×10^6/L to a high of 3.2×10^8/L. In general, direct counts decreased approximately one order of magnitude from one to 200 metres depth. High values were obtained in surface waters where phytoplankton blooms were ongoing or recent, as evidenced by depleted

nutrients. Within a water column, the correlation of phytoplankton numbers and direct count of bacteria was high. Poor correlations were obtained when comparing different areas since the bacterial flora was found to remain in large numbers where phytoplankton numbers were declining in the absence of nutrients. Figure 7 shows the range of values of direct count in one metre water of all stations occupied in April 1978.

During the August cruise of 1978 (Table 9), direct counts ranged from a low of 1.8×10^7 to 1.2×10^9 cells/L and were generally an order of magnitude higher than during spring conditions. The highest values for direct counts of bacteria during the August cruise were found at the two northernmost latitudes, 65°N and 66°N, where there was evidence of recent blooms of phytoplankton. Figure 8 shows the range of values for direct counts of bacteria in one metre water at stations occupied in August.

Total viable heterotrophs (TVH) and numbers of oleoclasts observed on the three cruises are presented in Tables 10, 11 and 12. Numbers of oleoclasts from the April 1978 cruise are not available. Figures 9, 10 and 11 present four ranges of counts of TVH in one metre water at all stations occupied. As expected, these values were considerably less than comparable values obtained by direct count. However, they showed similar trends in that summer values were much higher than spring values.

Estimates of the numbers of oil-degrading bacteria or oleoclasts in one metre water of all stations occupied on the spring cruise of 1977 and the August cruise of 1978 are seen in Tables 10 and 12 respectively. These values represent the best assessment possible at this time. The data are summarized in Figures 12 and 13. Oleoclasts increased in summer waters over those seen in spring waters by an average of approximately one order of magnitude. This reflected the general increase in the numbers of heterotrophic bacteria from spring to summer. Their distribution in summer waters did not demonstrate any particular pattern. The highest values at this time were at stations 21, 23, 30 and 34.

4.4 Bacterial Heterotrophic Activity

4.4.1 Uptake of glutamic acid

Use of the method of heterotrophic potential permits an evaluation of the physiological state of the heterotrophic bacterial flora in a water mass. The heterotrophic flora is that flora which requires complex organic molecules as a source of energy and carbon for growth and multiplication, and constitutes most of the bacteria in the marine ecosystem.

Of the several kinetic parameters generated by the method of heterotrophic potential, maximum velocity (Vmax) is perhaps the most important for the purposes of this report. Vmax is a calculation of the maximum rate at which a bacterial flora can take up or incorporate an

organic compound or substrate in a situation where the available organic substrate in the water is in excess and is saturating the ability of the organisms to use it. As such, Vmax represents a "potential" heterotrophic activity since the natural concentration of the substrate in the water is almost always less than a saturating concentration. Since the concentration of various organic substrates is dependent on their production and extrusion by primary producers, i.e. phytoplankton, a close relationship exists between primary production by phytoplankton and the incorporation or uptake of that production by bacteria.

The addition of a radioactive organic substrate to a water sample supplements the level of the natural substrate already present in the water due to its production by phytoplankton. This concentration of natural substrate, although unknown, is taken into consideration in the calculation of Vmax. The radioactive substrate employed throughout the cruises was glutamic acid, an amino acid produced by phytoplankton and readily utilized by marine bacteria. Other kinetic data generated by this technique include (K+S) and (T) which are described earlier in this report. Their values, together with values of Vmax for all stations occupied on the three cruises, are presented in the appendix. These data, however, will be treated in a later report in relation to concentrations of dissolved and particulate organic carbon at occupied stations.

The heterotrophic activity of bacteria in Davis Strait closely paralleled the blooms of phytoplankton. Values obtained for Vmax of glutamic acid in one metre water are presented in Tables 13, 14 and 15 for the cruises in April-May 1977, April 1978 and August 1978 respectively. A summary of these data is seen in Figures 14, 15 and 16. The calculated maximum velocity of glutamic acid uptake in one metre waters sampled during the spring cruises were generally two to four times higher in the presence of a phytoplankton bloom than in the same waters in August when the bloom had declined.

At latitude 63°N, Vmax at one metre for three stations sampled in April 1978 was an average of 7.2 µg glutamic acid per litre of seawater per day. At the same latitude in August 1978, the average Vmax at four stations was 2.3 µg/L/day. This reduction of potential activity by a factor of 3.2 occurred in spite of an increase in bacterial numbers. At the time of sampling in April, phytoplankton production had occurred and nutrients were already depleted in the upper part of the water column. In August, nutrients had not been regenerated in the water mass sampled, phytoplankton production was negligible and the bacterial flora was incorporating substrate at a reduced potential rate in response to the diminishing availability of the substrate.

An example of a "prebloom" station in winter conditions was station 30A occupied in May 1977. Ice conditions were very heavy at this station and approximately one third of a metre of slush was floating in the open leads. The bloom of phytoplankton had presumably started only a short time before the station occupation and the Vmax of heterotrophic bacterial activity in one metre water was 0.47 µg/L/day. In contrast to this value,

stations occupied to the east at this latitude were in bloom conditions and the average Vmax of five stations was 4.10 µg/L/day. At latitudes below 63°N in April 1977, only stations 43, 46, 62 and 63 had low maximum velocities typical of winter conditions.

In the second spring cruise (April 1978), the majority of stations were in winter conditions in that there was no evidence of phytoplankton blooms and nutrient levels were high. Bacterial activity as well as numbers were low at these stations. The average Vmax at four stations on latitude 60°N was 0.46 µg/L/day. This is in contrast with an average Vmax of four stations at the same latitude in August of 2.66 µg/L/day, well after the phytoplankton bloom in May (MacLaren Marex Inc., 1979a).

At selected stations on the three cruises, profiles of bacterial activity were made from one to 200 metres depth. The results of these are presented in Tables 16, 17 and 18 for the cruises in April 1977, April 1978 and August 1978 respectively. Profile stations in the spring and summer cruises demonstrated little variability in Vmax at the lower depths. The average value in April 1977 at 200 metres was 0.224 µg/L/day, in April 1978, 0.23 µg/L/day, and in August 1978, 0.30 µg/L/day with station 34 excluded.

Station 34 in the mouth of Frobisher Bay demonstrated an average Vmax at five depths from one to one hundred metres of 1.60 µg/L/day. However, at 200 metres, a Vmax of 9.37 µg/L/day was determined. Values of total viable count and particulate organic carbon were also very high. The water mass at this depth formed part of the south-flowing Baffin current (Dr. S. A. M. Conover, personal communication) and the unusually high activity was probably in response to the remnants of an earlier inshore phytoplankton bloom at a higher latitude.

Profile stations which could be considered to be in winter conditions during the spring cruises of 1977 and 1978 showed only minor changes in Vmax from one to 200 metres. The average Vmax of these stations ranged from 0.45 µg/L/day at one metre to 0.15 µg/L/day at 200 metres. In contrast, the other profile stations of both spring cruises had phytoplankton blooms in progress and the average Vmax ranged from 4.83 µg/L/day to 0.28 µg/L/day.

Profiles made during the August cruise ranged in average Vmax from 2.81 µg/L/day to 0.27 µg/L/day again excluding station 34. Figure 17 compares a spring and summer profile station from each of four latitudes. At latitude 63°N, the data from station 30A in May 1977 suggested prebloom conditions. Phytoplankton numbers were low and nutrient levels were high. The average Vmax of four depths to fifty metres was 0.47 µg/L/day. In August, at the same latitude, station 30 was determined to have an average Vmax of 4.41 µg/L/day, suggesting a recent and diminishing bloom of phytoplankton. At latitude 62°N, the average Vmax to fifty metres in May 1977 was 5.16 µg/L/day during a bloom. In August 1978 at this latitude, the average Vmax to fifty metres at station 40 was 0.82 µg/L/day and, together with low phytoplankton numbers and depleted nutrients, suggested

a bloom earlier in the year. Station occupations in the two seasons at latitude 61°N demonstrated a uniformly low Vmax throughout the water column in April 1978 in "prebloom" conditions and a similarly low Vmax in the water column at station 49 in August, in "postbloom" conditions. At latitude 60°N, the average Vmax to fifty metres at station 60 in April 1977 was 2.19 µg/L/day during a developing bloom. Station 59, at the same latitude in August had an average Vmax to fifty metres of 3.42 µg/L/day. The large numbers of phytoplankton at this station, together with high heterotrophic activity, were probably sustained by nutrient replenishment, possibly by upwelling along the Labrador coast.

Figure 18 demonstrates the relationship between bacterial Vmax and phytoplankton numbers in a track of profile stations occupied during August 1978. The profile at station 34, in the mouth of Frobisher Bay is also included. The unusually high Vmax at the 200 metre depth was previously discussed. The track of profile stations was occupied from south to north and new water masses were continually encountered in the south-flowing current. Several of these stations have been previously discussed and this figure is included to summarize the relationship of phytoplankton production to heterotrophic activity by bacteria. The data suggest gradually declining blooms of phytoplankton from station 3 through 11 to station 19. Potential heterotrophic activity was also declining through these stations, although probably increasing at the 20 metre depth. At station 30, Vmax was probably near a seasonally high level, due perhaps to a prior phytoplankton bloom sustained by coastal upwelling. Potential bacterial activity at stations 40 and 49 had receded in water masses exhausted of nutrients and carbon sources. Station 59, as previously described, demonstrated high bacterial activity. In this instance, phytoplankton production and consequent heterotrophic activity were probably sustained by coastal upwelling of lower depth nutrients.

The interpretation of microbiological data provides a reasonable evaluation of the "biological state" of a given water mass. The method of heterotrophic potentials is an accurate measurement of an activity which is closely associated with primary production. The elucidation of this activity appears to yield a dynamic interpretation of interrelationships in the ecosystem of such parameters as nutrient concentrations and numbers of bacteria and phytoplankton. As explained at the beginning of the text, a subsequent report will draw together microbiological observations at inshore areas of Frobisher Bay, including other kinetic parameters of heterotrophic activity. Further discussion of the data in this report will then be possible.

4.4.2 Uptake of hexadecane

Alkanes are organic compounds which can be readily utilized by a proportion of the heterotrophic bacterial flora in many environments. These heterotrophic cells are referred to here as oleoclasts. Heterotrophic incorporation of alkanes by oleoclasts results in growth and multiplication of the cells and the evolution of respired alkanes as carbon dioxide (CO_2).

By using ^{14}C-labelled hexadecane, a sixteen-carbon alkane, as a radioactive label in weathered crude petroleum, CO_2 evolved by the cells exposed to the labelled crude petroleum contains a proportion of $^{14}CO_2$ which can be measured. A deficiency of the technique at this time is that radioactive hexadecane assimilated and retained by the cells cannot be measured due to technical problems. Only that hexadecane which is completely metabolized or mineralized to $^{14}CO_2$ and then released by the cells can be measured.

Despite technical problems, a degree of success was attained with the technique in the first year of its use. A sixteen-day incubation period was arbitrarily chosen for the April 1978 cruise in the absence of prior knowledge of the time required. On the August cruise, after evaluating some of the results from the April cruise, the incubation time was extended to 25 days. The results are seen in Tables 11 and 12 and, to facilitate comparison, are presented as the maximum disintegrations per minute (DPM) of $^{14}CO_2$ recovered after 16 days in the April cruise (Table 11) and 15 days in the August cruise (Table 12).

On the April cruise, the average maximum DPM of $^{14}CO_2$ obtained from one metre water at 16 stations was 13,636, with a range from 353 to 62,324 DPM. These values are in contrast to the values obtained in August when the average maximum DPM obtained at 30 stations was 1753 with a range from 139 to 8493 DPM. The results are summarized in Figures 19 and 20 as four ranges of observed maximum DPM. During the spring cruise (Fig. 19), the amount of mineralization was generally high at stations occupied in the more southern latitudes from 59° to 62°N. As previously observed, the surface waters of these latitudes were in "prebloom" or winter conditions and had high levels of nutrients in April 1978. At latitudes 63° and 64°N, a spring phytoplankton bloom was in progress and nutrients were depleted in the upper parts of the water columns, except station 24 where some nutrients remained. Mineralization at the more northern latitudes, particularly latitude 63°N, was comparatively low.

During the August cruise (Fig. 20) nutrients were essentially depleted in most areas except along the coast of Baffin Island where concentrations may have been high due to upwelling, and at latitude 60°N where relatively high nutrient levels may have been a reflection of the northward-flowing Atlantic current. In general, the greatest amount of hexadecane mineralization occurred in those areas where nutrients were available. In nutrient-depleted areas, hexadecane mineralization was generally low.

The numbers of oleoclastic bacteria were seen to increase by an average of approximately one order of magnitude between spring and summer observations. This coincided with a general ten-fold increase in the number of heterotrophic bacteria, a consequence of primary production. However, this increase in the oleoclastic population capable of mineralizing hexadecane was not reflected in the amount of mineralization observed. The spring value for maximum DPM was 7.8 times that seen in the summer, in spite of a smaller population of oleoclasts. The limiting factor in summer waters would appear to be low

nutrient levels. A comparison of nitrate concentrations, numbers of oleoclasts and maximum DPM obtained from hexadecane mineralization in one metre water of the August stations is shown in Figure 21. Although oleoclastic bacteria were present in varying numbers at all stations sampled, the amount of hexadecane mineralization generally varied directly with available nitrate.

The above results would tend to suggest that petroleum in south Davis Strait would be readily degraded to some degree during early spring conditions. At this time the concentration of nutrients in surface waters would be sufficient to facilitate degradation and mineralization. However the presence of petroleum in the ecosystem at this time would have unpredictable effects on the spring phytoplankton bloom, an event which was seen to be necessary for the activity and increase of heterotrophic bacteria including oleoclasts. With a large amount of petroleum substrate available, however, oleoclasts might increase to form a large proportion of the total heterotrophic population and deplete nutrient levels during the process of degradation. In this scenario, neglecting currents and vertical mixing, nutrients would then be unavailable for a phytoplankton bloom in the area of petroleum contamination.

In summer waters the lack of nutrients, depleted by an earlier spring phytoplankton bloom, would tend to limit the rate and amount of degradation of petroleum entering the surface waters during this period. Although speculative at this time, it seems reasonable to conclude that an influx of petroleum into south Davis Strait during summer or fall would probably be largely entrained in winter ice if it were not beached or dissipated in some other fashion.

5.0 CONCLUSIONS

Several preliminary conclusions concerning Davis Strait can be made at this time.

1. The spring phytoplankton bloom is important for the summer development of the bacterial flora in Davis Strait. Heterotrophic bacteria, including oleoclastic populations, increased by approximately one order of magnitude in response to primary production by phytoplankton in surface waters. As might be expected, oleoclasts appear to be part of the bacterial flora in all surface waters of south Davis Strait.

2. The potential heterotrophic activity of bacteria increases rapidly in surface waters in response to primary production. This potential activity is a reflection of the actual activity which results in an increase of the bacterial biomass.

3. Primary production declines as nutrients are depleted in the water column, and the availability of organic substrates to bacteria, at least of glutamic acid, presumably declines also. This results in a reduced potential heterotrophic uptake of glutamic acid, in spite of a large population of heterotrophs.

4. Below fifty metres, potential heterotrophic activity is uniformly low (excluding one observation) and this condition probably prevails in all seasons, unless strong vertical mixing occurs. Low activity is also suggested by low numbers of cells.

5. The ability of oleoclasts to utilize alkanes is limited by the availability of nutrients, particularly reactive nitrate. As a consequence, a larger population in summer waters consumes smaller amounts of alkanes than in "prebloom" spring waters where smaller numbers of oleoclasts are not limited by nutrients.

6. Should an oil blowout occur during the period of exploratory drilling (August-October), it would coincide with a period of low nutrient levels in south Davis Strait. Released oil would be entrained in the subsequent winter ice. Degradation by oleoclasts of at least the alkane fraction of the oil should occur in spring when the oil re-enters water masses containing adequate nutrients. The localized effect of the oil on the development of the under-ice flora of phytoplankton and the bloom of phytoplankton in the water cannot be predicted at this time.

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7.0 FIGURES

Figures 1-21

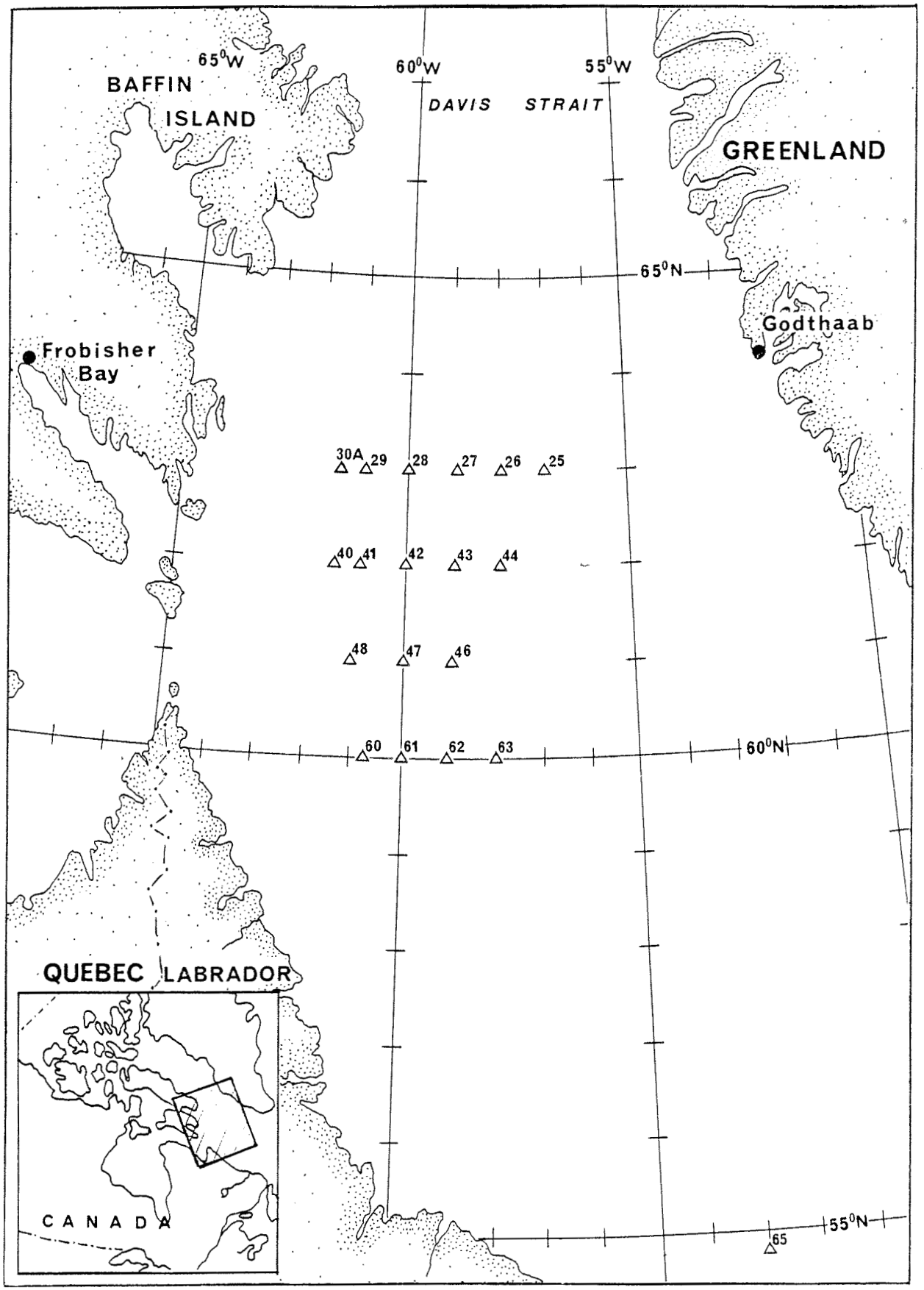

Figure 1. Stations occupied during cruise 77-2 in April-May 1977.

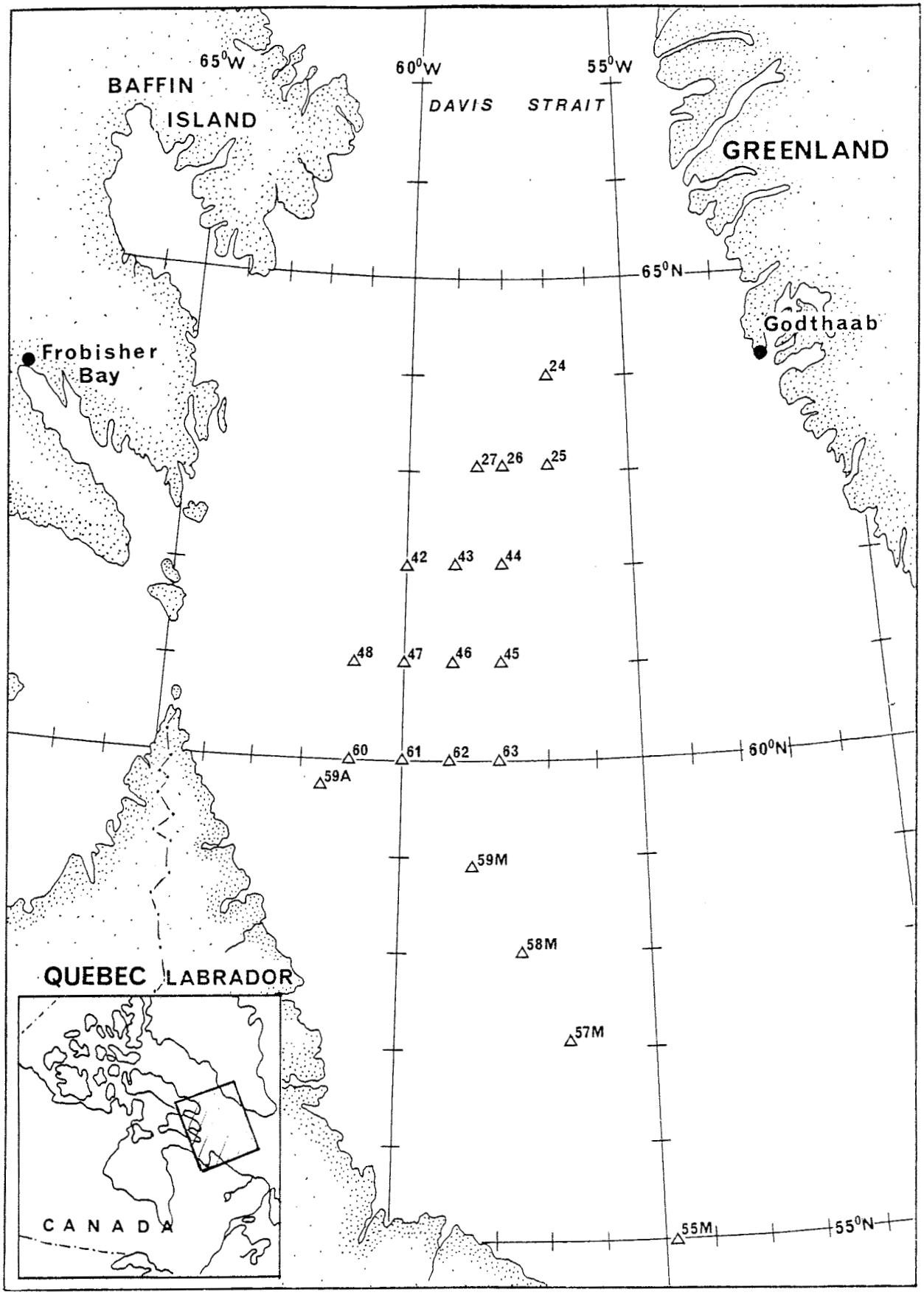

Figure 2. Stations occupied during cruise 78-1 in April 1978.

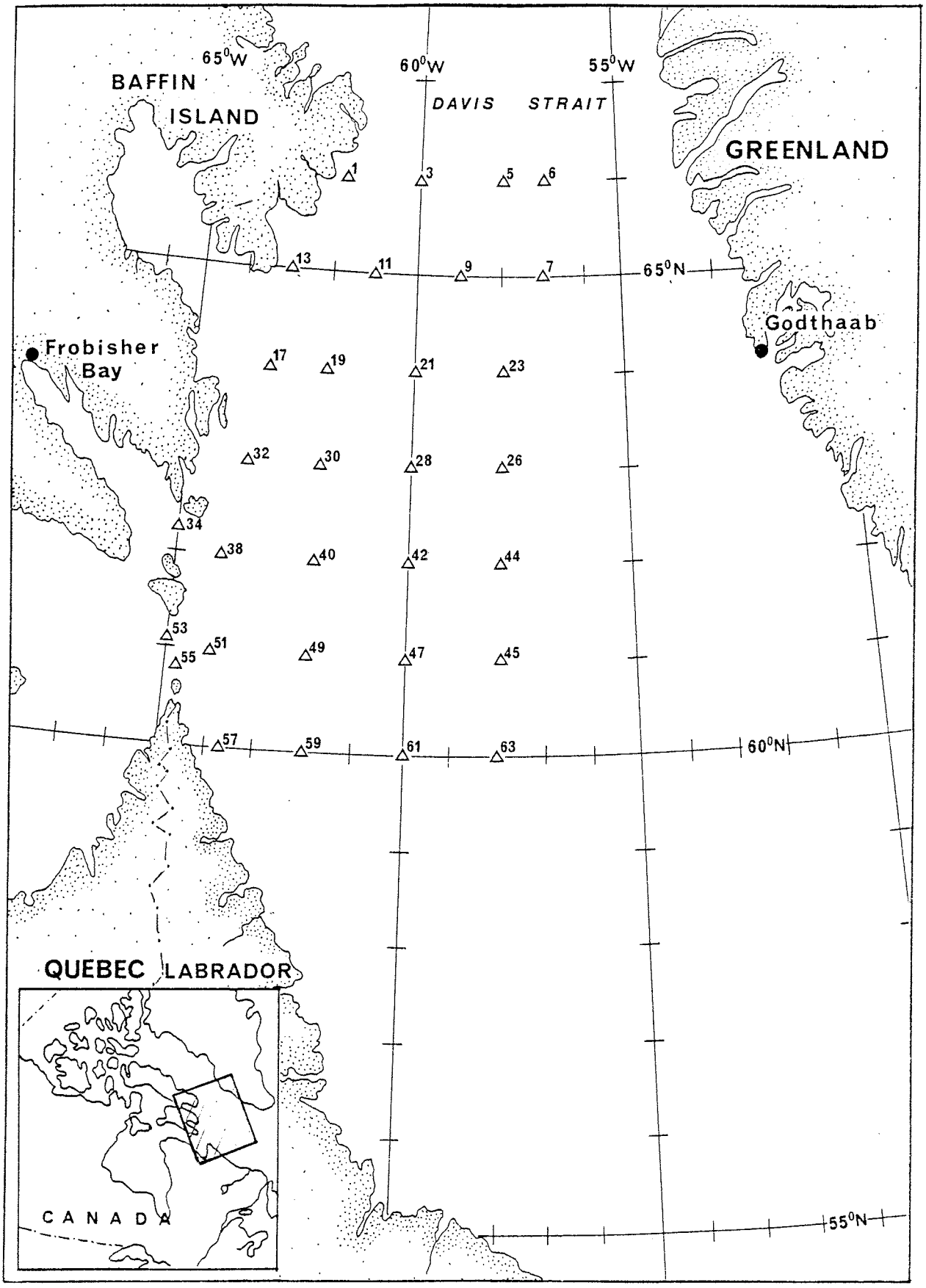

Figure 3. Stations occupied during cruise 78-2 in August 1978.

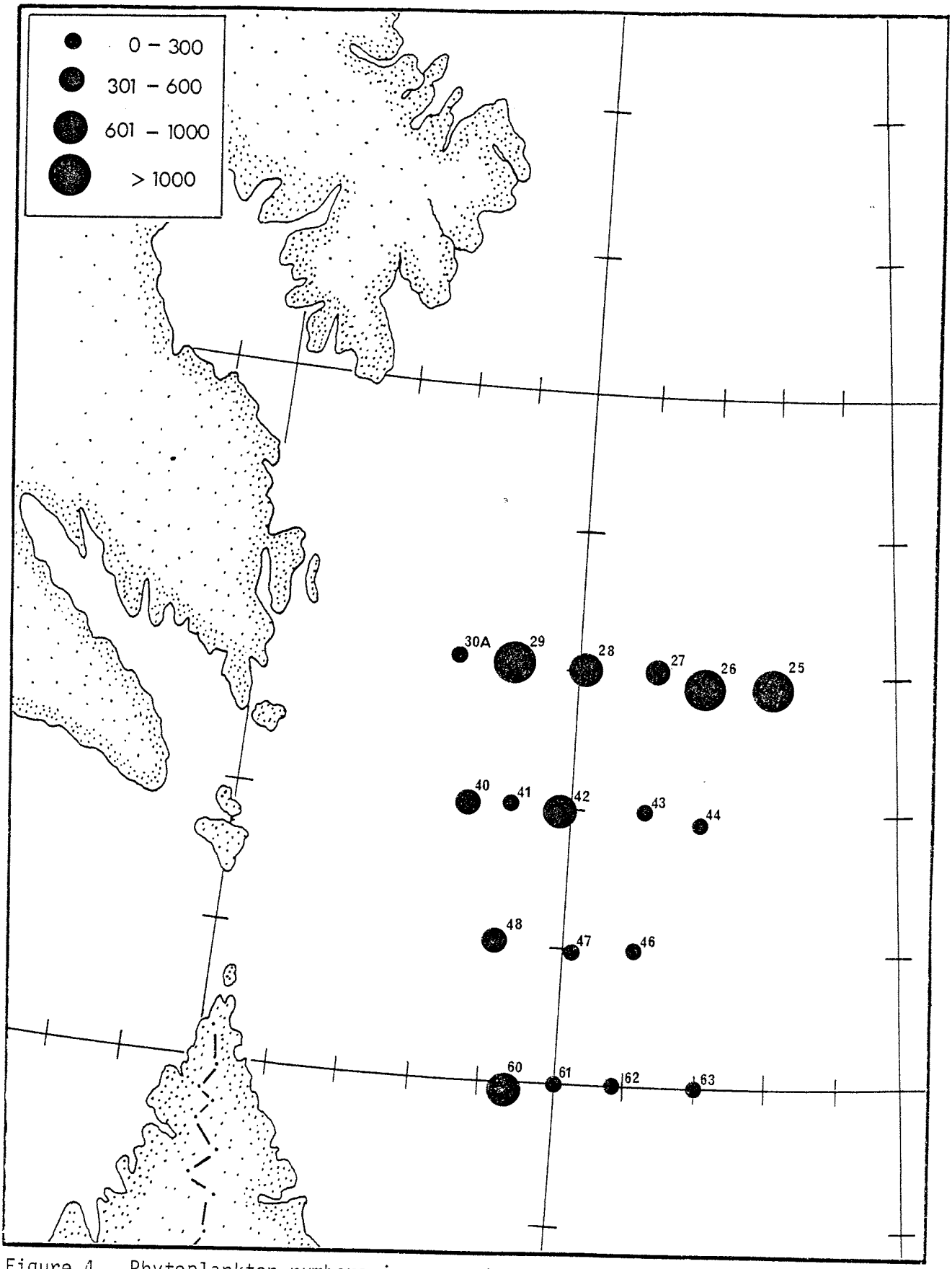

Figure 4. Phytoplankton numbers in one metre water at stations occupied in Davis Strait during April-May 1977. Number of counts X 10^3 per litre of water are expressed in four ranges represented by four sizes of circles. Data were obtained from MacLaren Marex Inc.

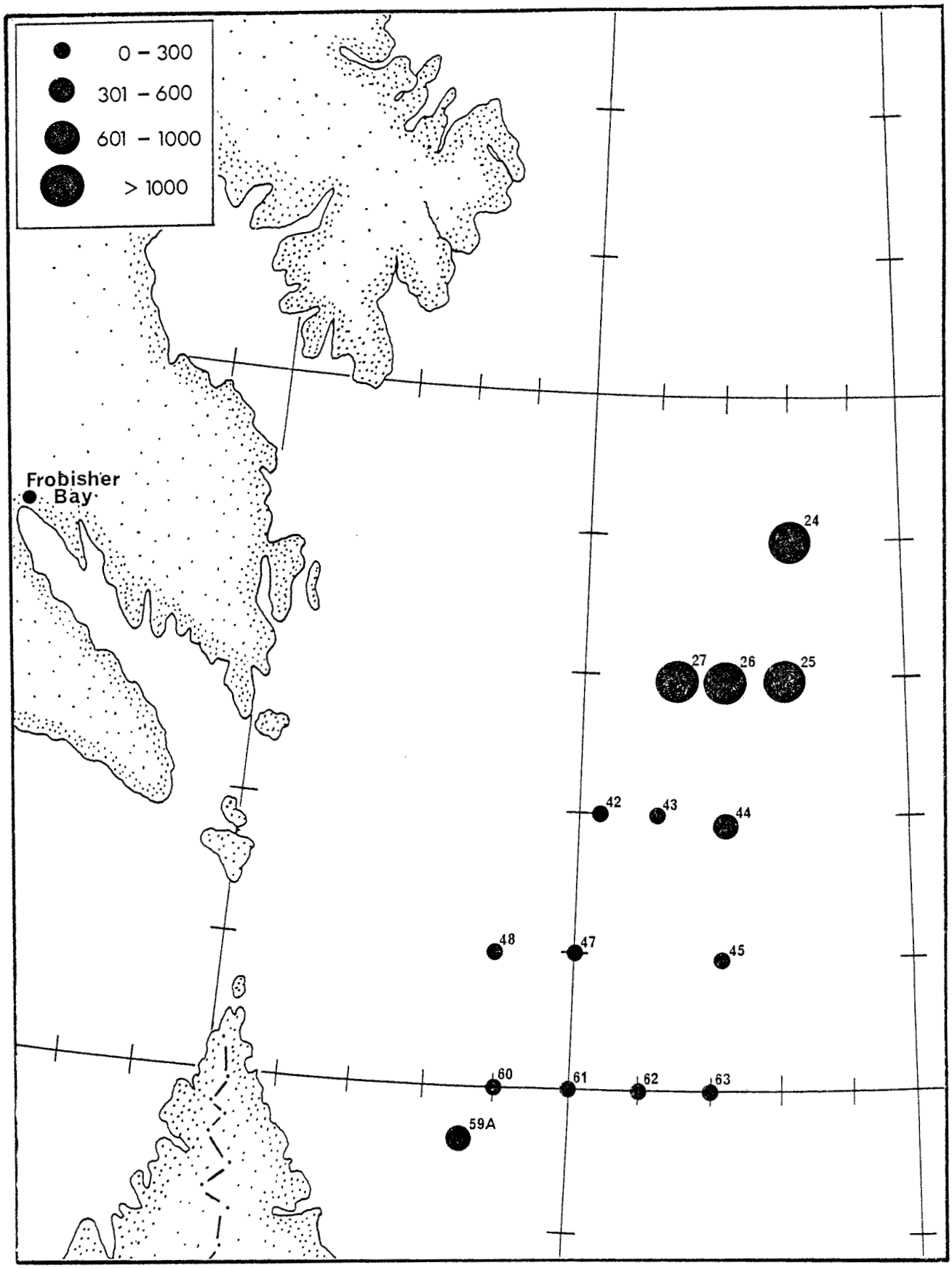

Figure 5. Phytoplankton numbers in one metre water at stations occupied in Davis Strait during April 1978. Number of counts X 10^3 per litre of water are expressed in four ranges represented by four sizes of circles. Data were obtained from MacLaren Marex Inc.

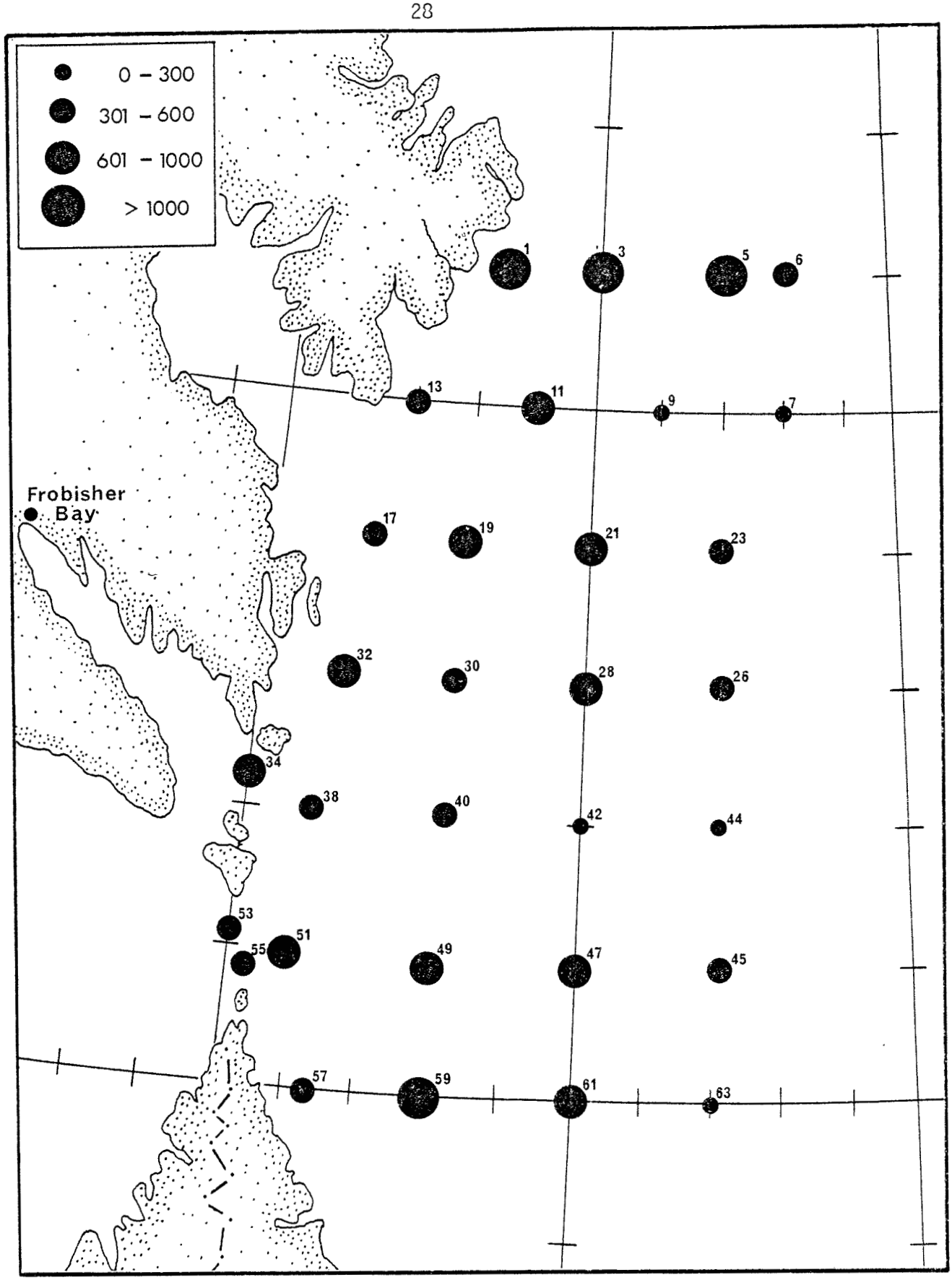

Figure 6. Phytoplankton numbers in one metre water at stations occupied in Davis Strait during August 1978. Number of counts X 10^3 per litre of water are expressed in four ranges represented by four sizes of circles. Data were obtained from MacLaren Marex Inc.

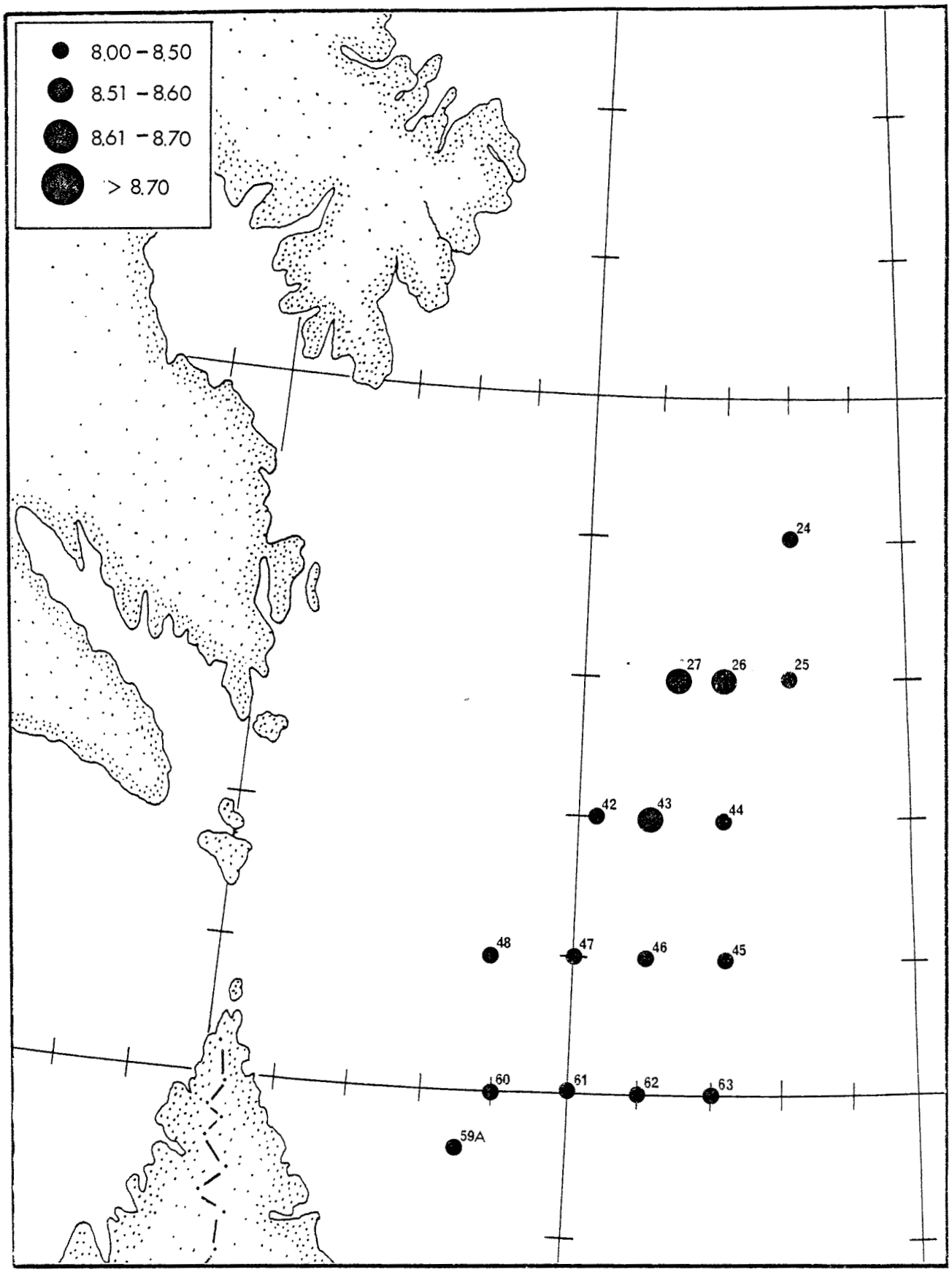

Figure 7. Total bacterial cells in one metre water at stations occupied in Davis Strait during April 1978. Log number of bacteria per litre of seawater is expressed in four ranges represented by four sizes of circles.

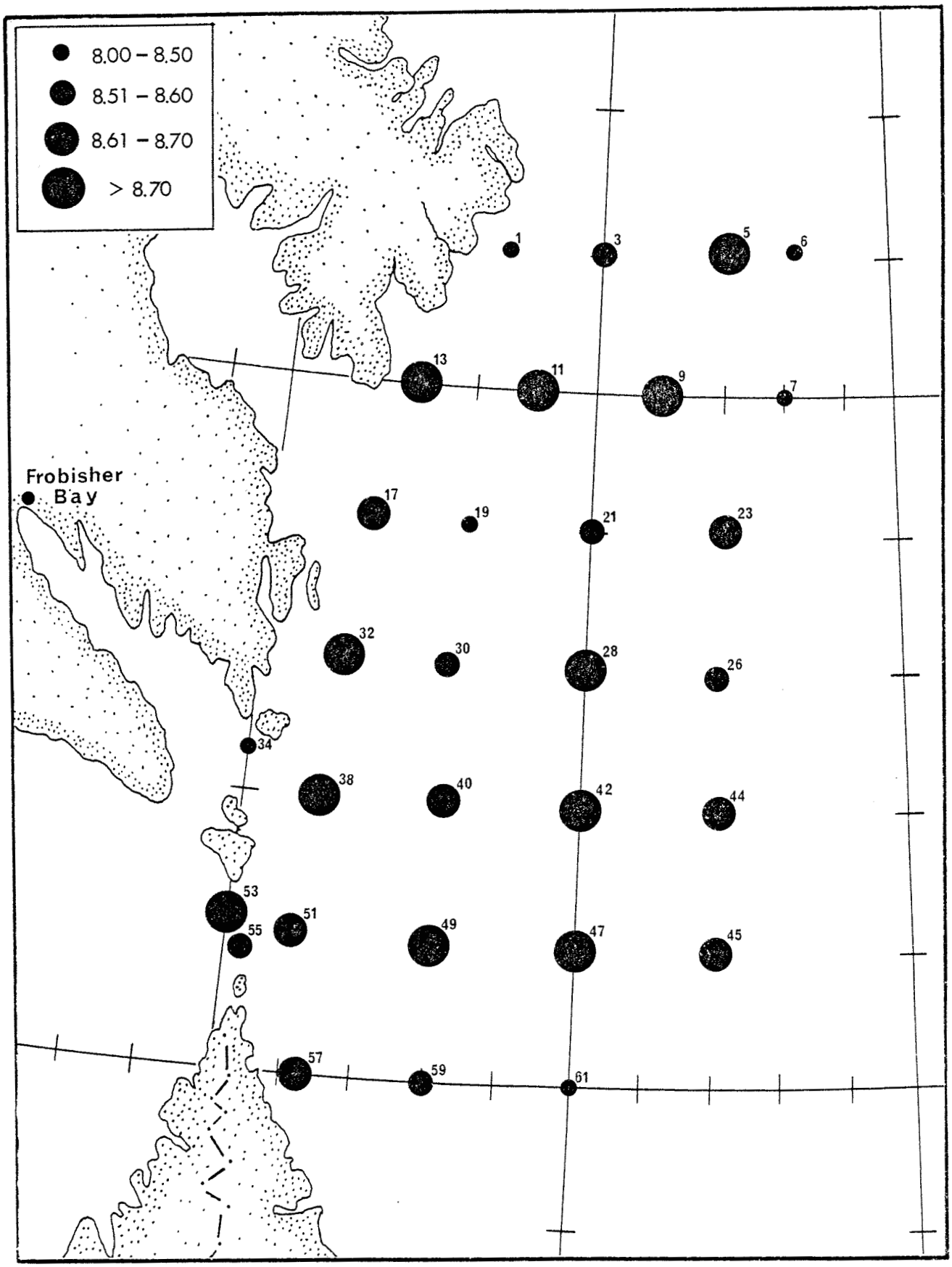

Figure 8. Total bacterial cells in one metre water at stations occupied in Davis Strait during August 1978. Log number of bacteria per litre of seawater is expressed in four ranges represented by four sizes of circles.

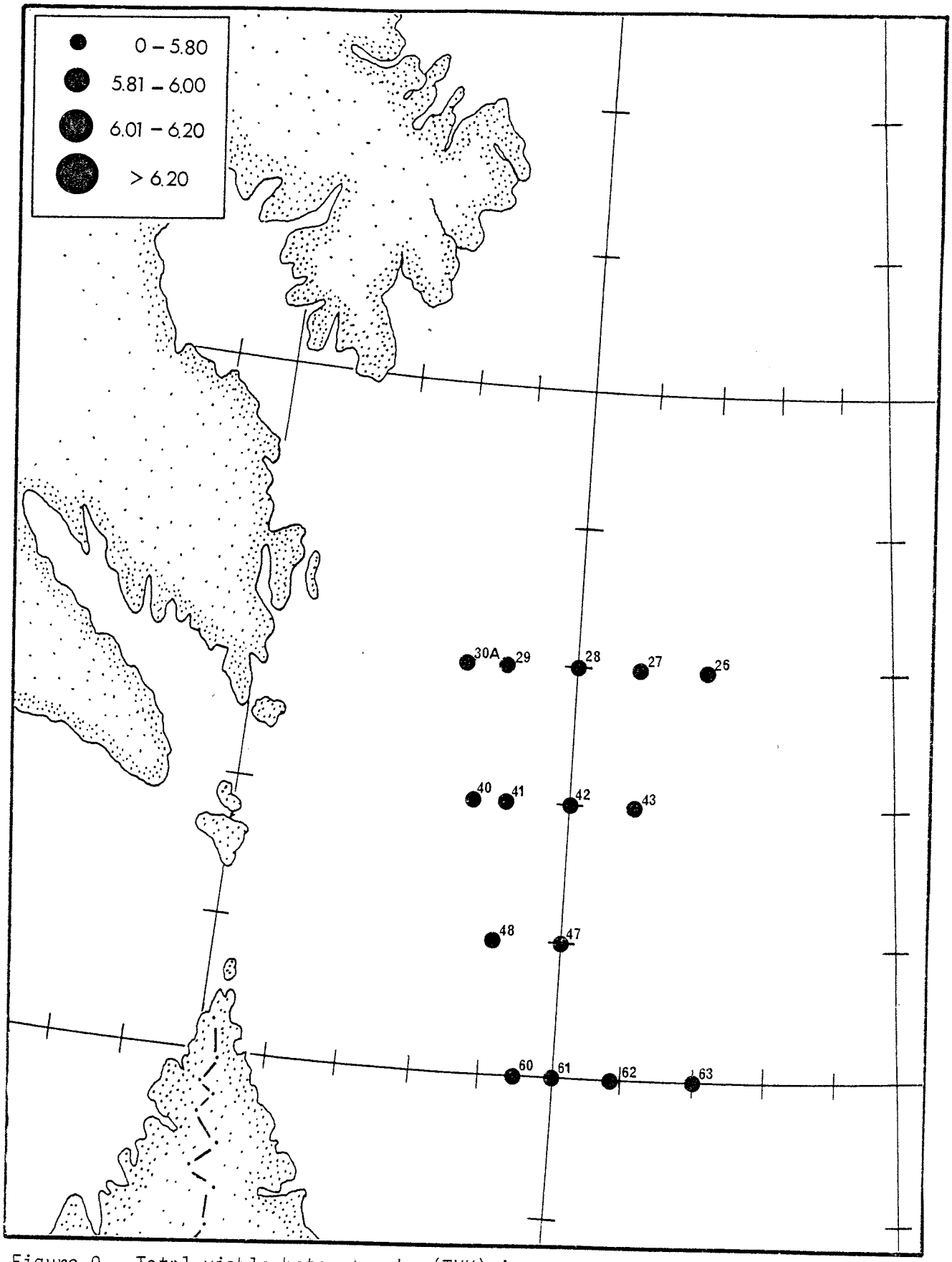

Figure 9. Total viable heterotrophs (TVH) in one metre water at stations occupied in Davis Strait during April-May 1977. Log number TVH per litre of water is expressed in four ranges represented by four sizes of circles.

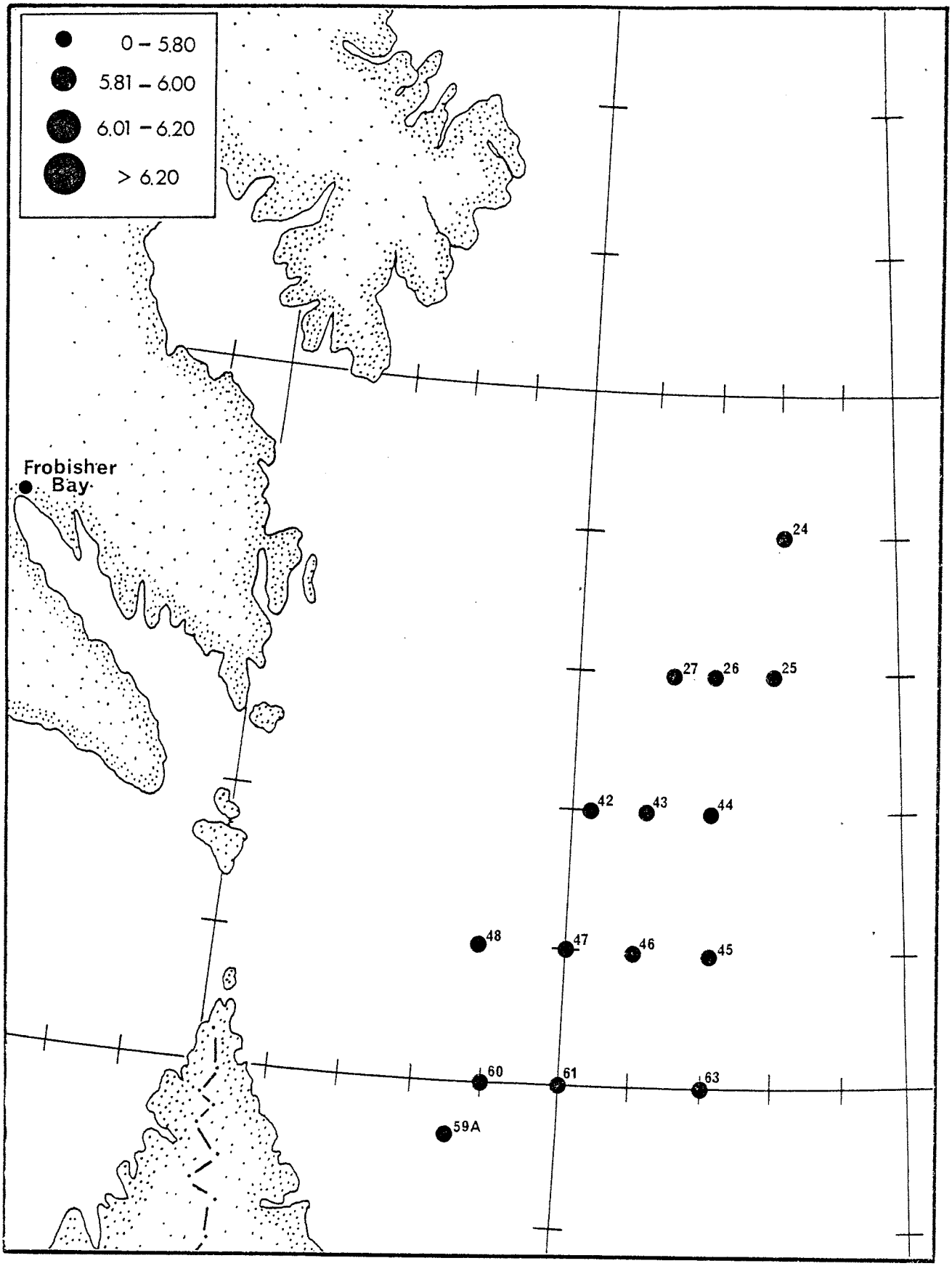

Figure 10. Total viable heterotrophs (TVH) in one metre water at stations occupied in Davis Strait during April 1978. Log number TVH per litre of water is expressed in four ranges represented by four sizes of circles.

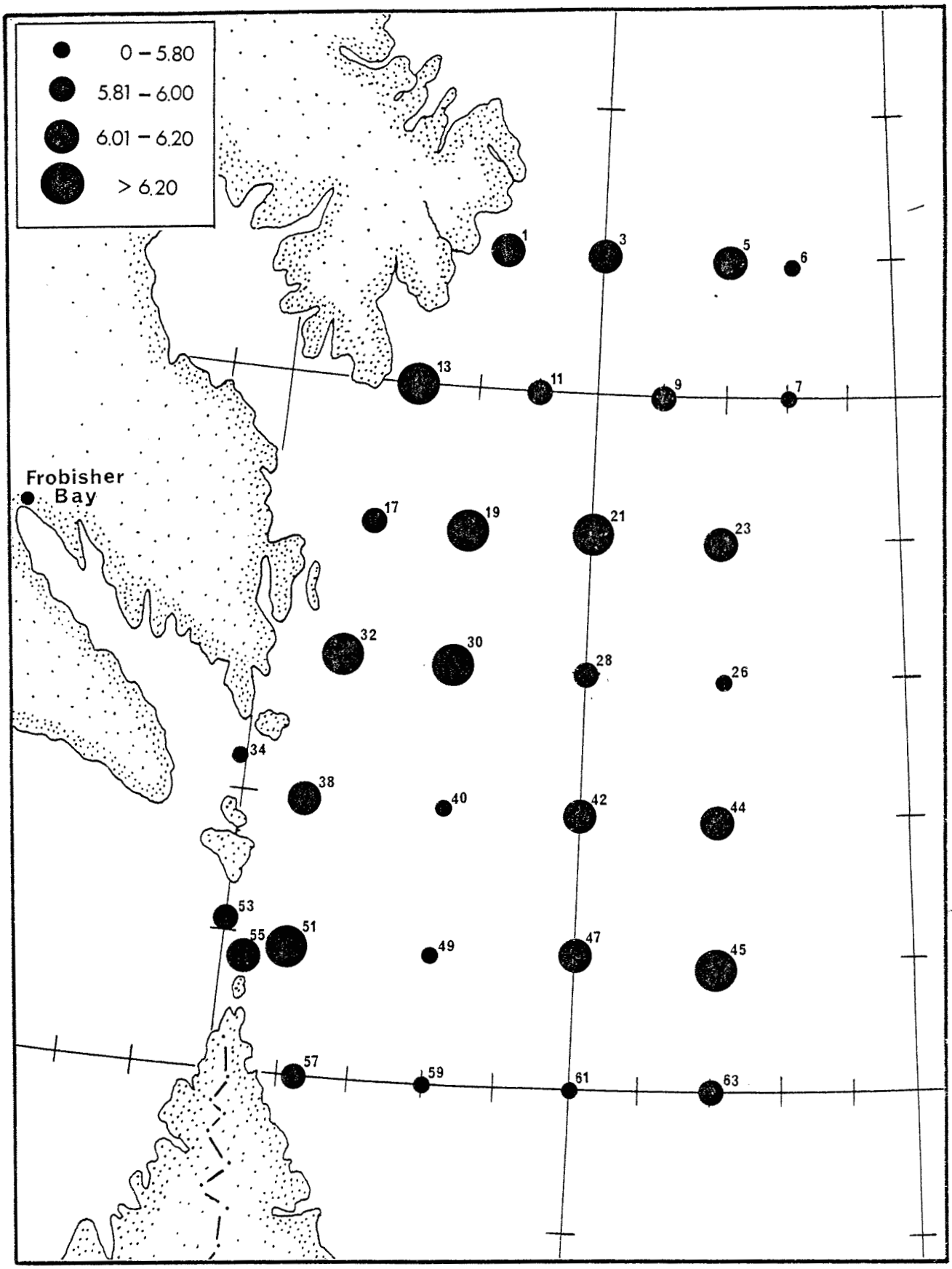

Figure 11. Total viable heterotrophs (TVH) in one metre water at stations occupied in Davis Strait during August 1978. Log number TVH per litre of water is expressed in four ranges represented by four sizes of circles.

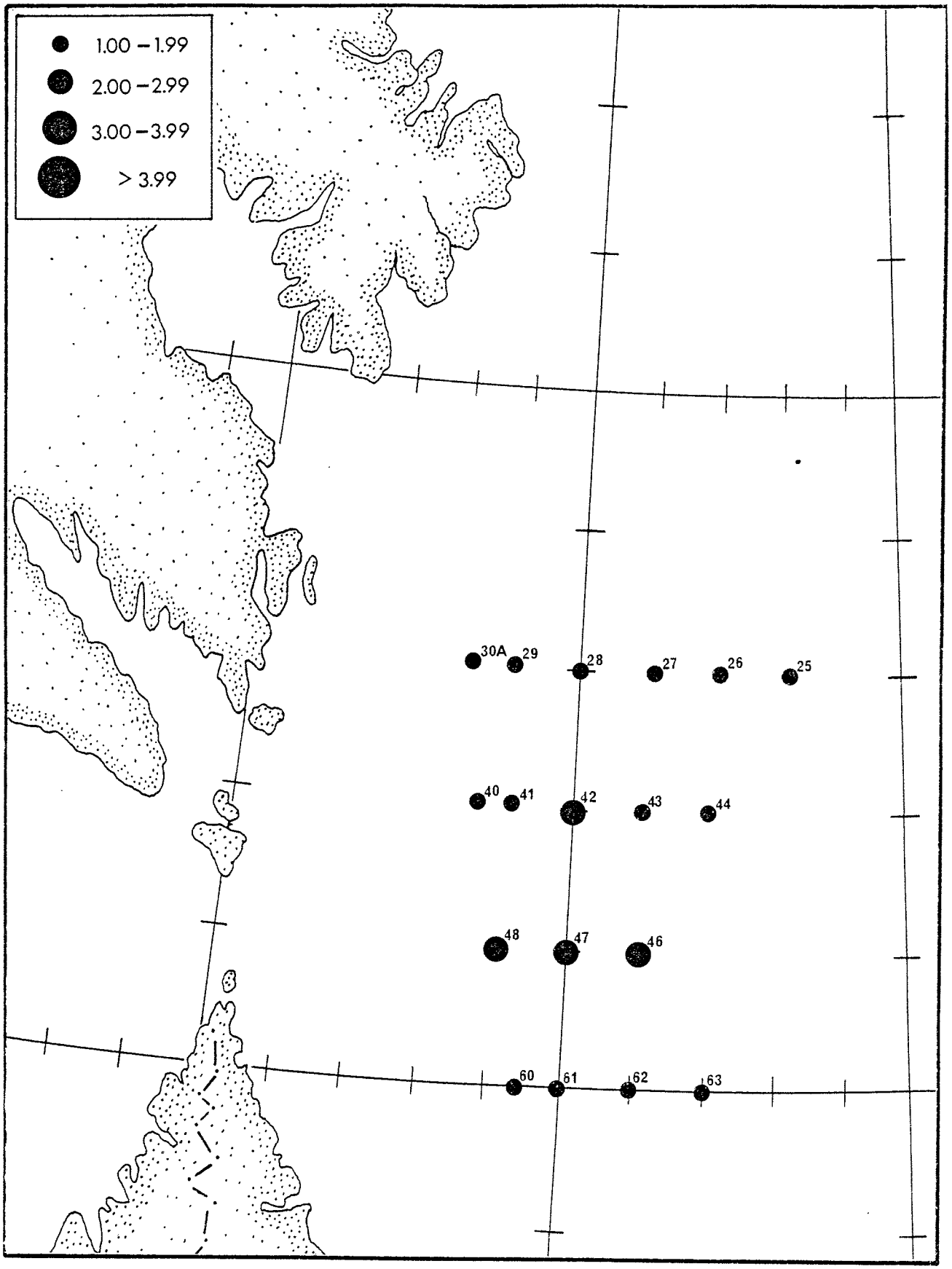

Figure 12. Numbers of oleoclasts in one metre water at stations occupied in Davis Strait during April-May 1977. Oleoclasts are represented as log of the most probable number (MPN) per litre of seawater and expressed in four ranges represented by four sizes of circles.

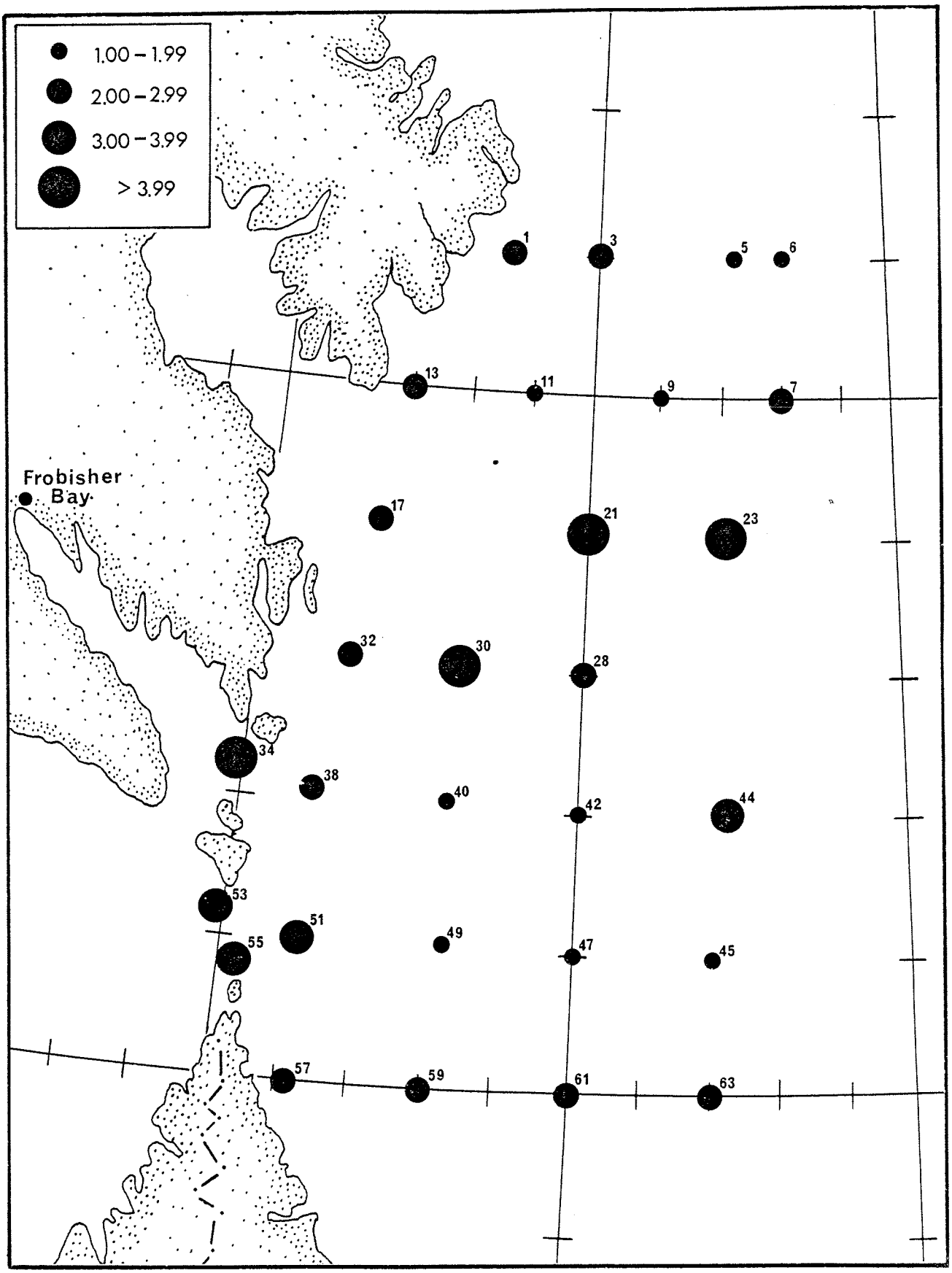

Figure 13. Numbers of oleoclasts in one metre water at stations occupied in Davis Strait during August 1978. Oleoclasts are represented as log of the most probable number (MPN) per litre of seawater and expressed in four ranges represented by four sizes of circles.

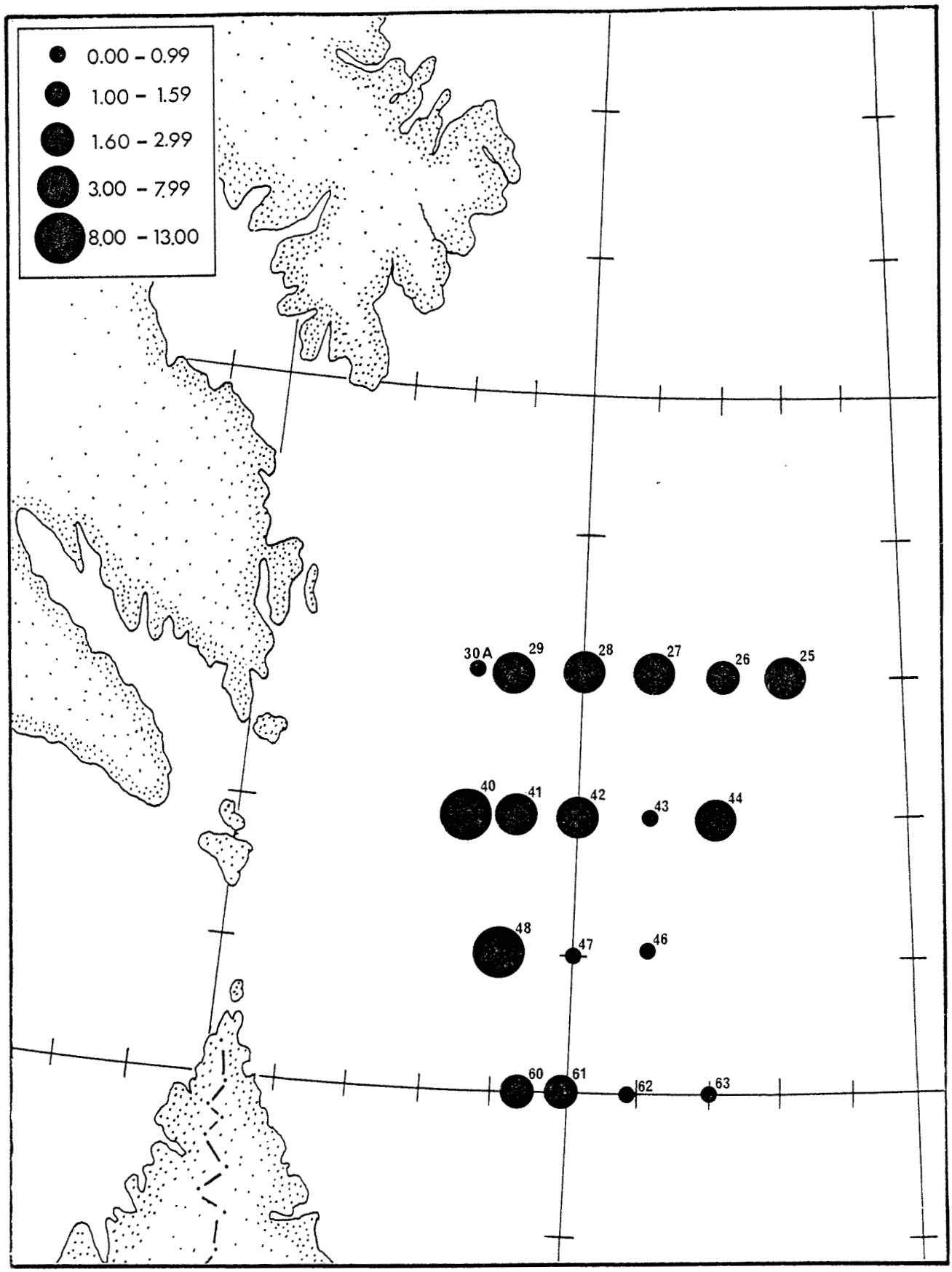

Figure 14. Maximum velocity (V max) of glutamate uptake represented by combined mineralization and assimilation in one metre water at stations occupied in Davis Strait during April-May 1977. V max in micrograms of glutamic acid per litre of seawater per day is expressed in five ranges represented by five sizes of circles.

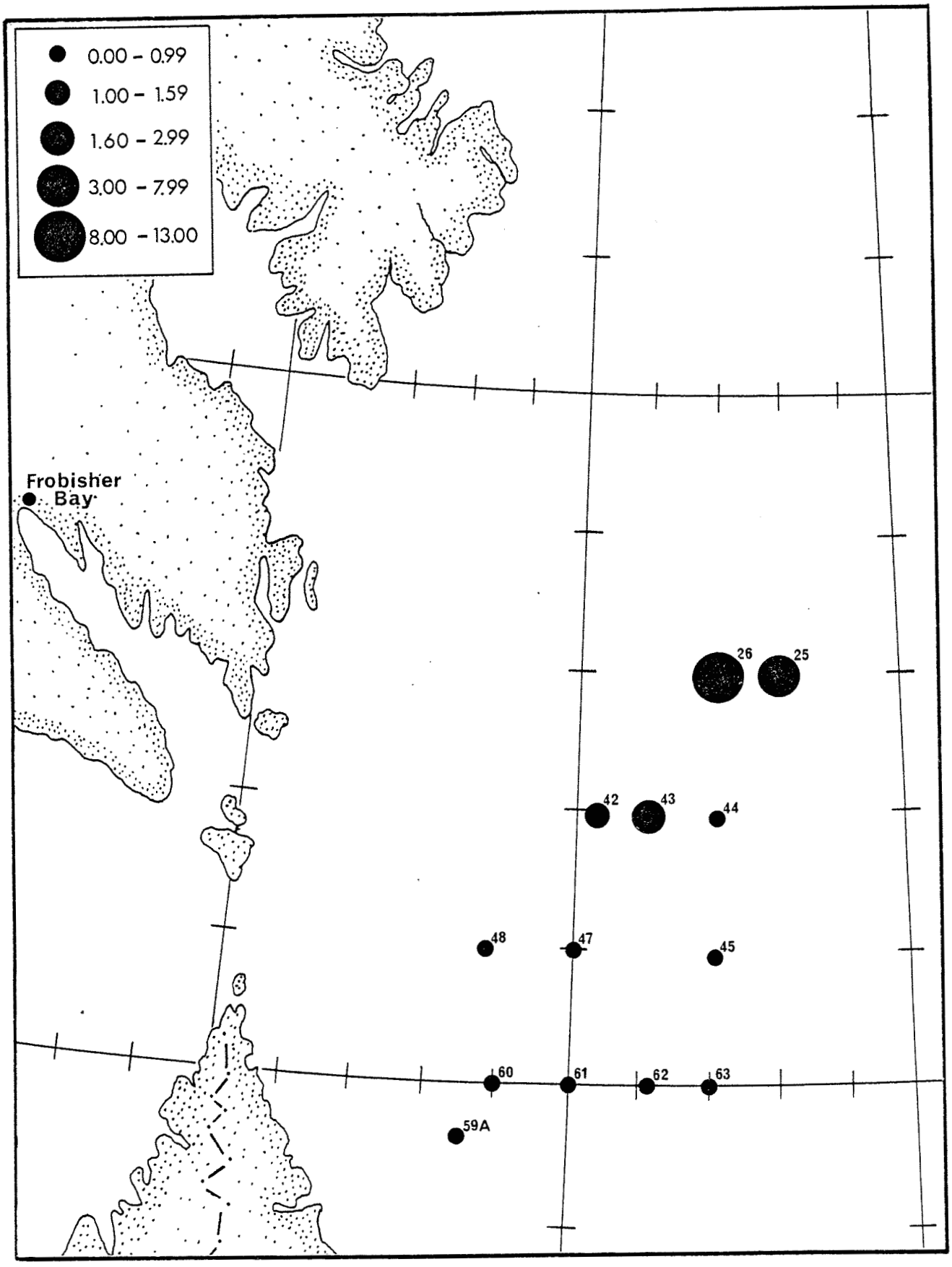

Figure 15. Maximum velocity (V max) of glutamate uptake represented by combined mineralization and assimilation in one metre water at stations occupied in Davis Strait during April 1978. V max in micrograms of glutamic acid per litre of seawater per day is expressed in five ranges represented by five sizes of circles.

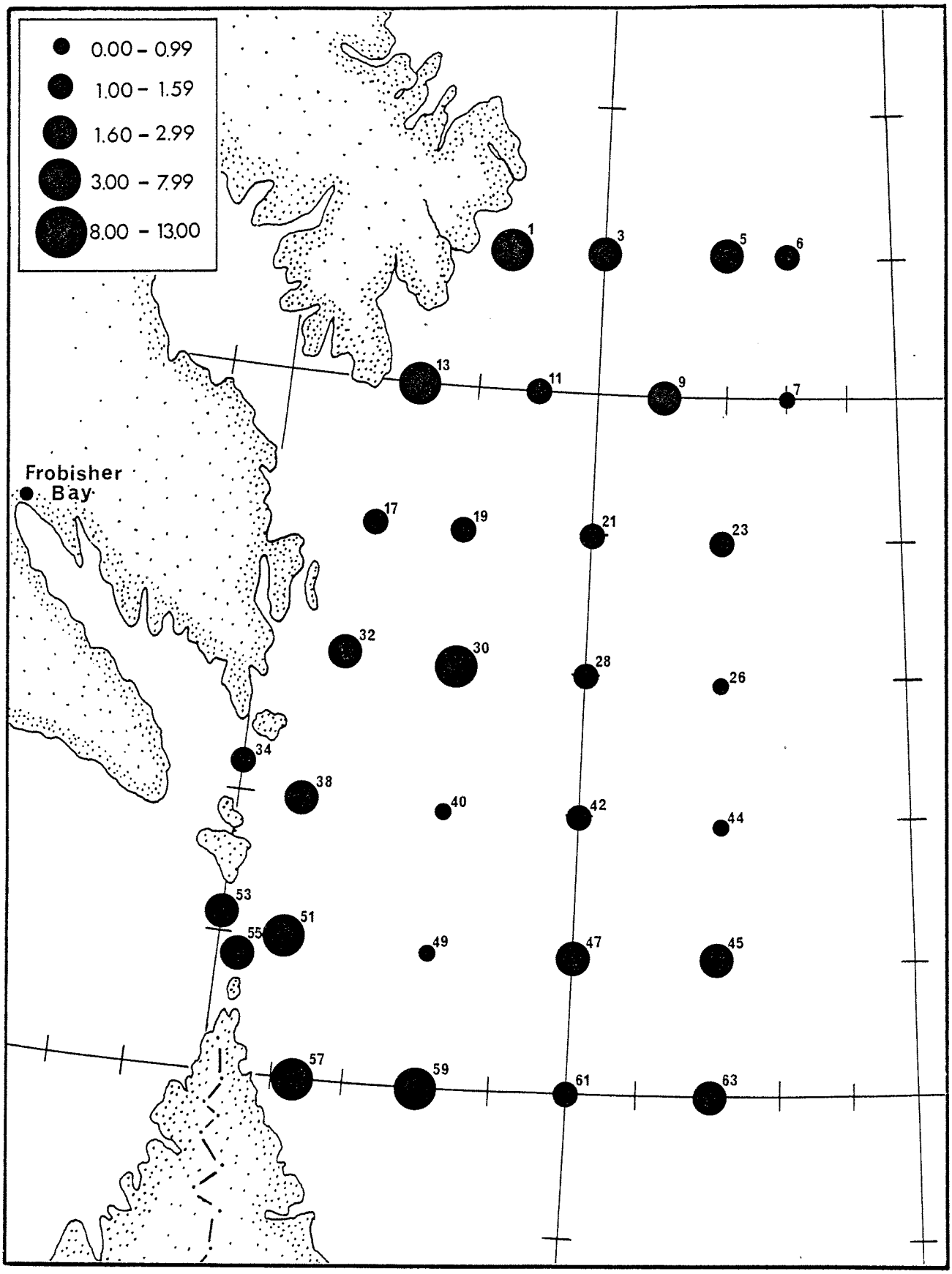

Figure 16. Maximum velocity (V max) of glutamate uptake represented by combined mineralization and assimilation in one metre water at stations occupied in Davis Strait during August 1978. V max in micrograms of glutamic acid per litre of seawater per day is expressed in five ranges represented by five sizes of circles.

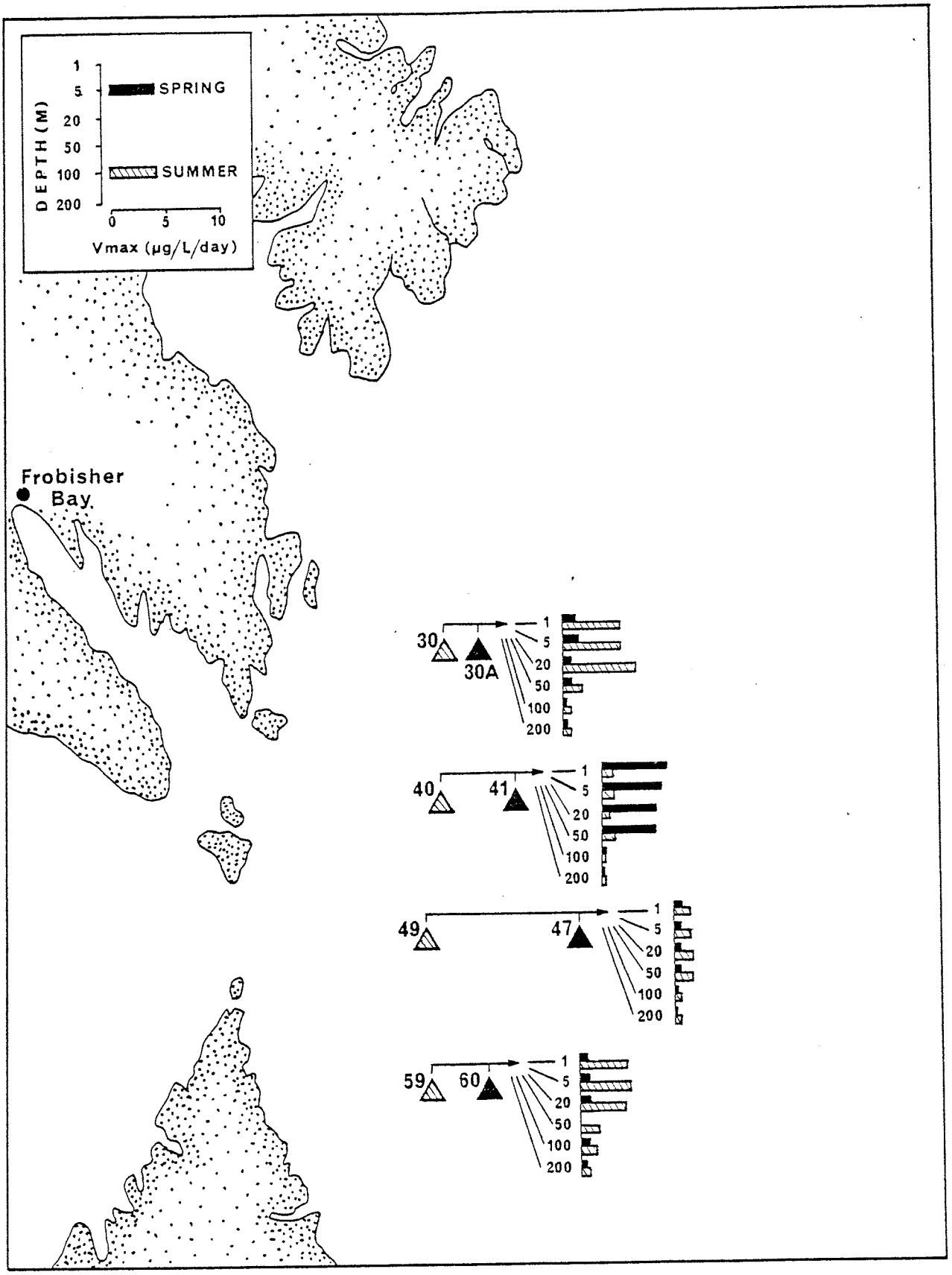

Figure 17. Comparison of spring and summer profiles of V max at four latitudes. Stations 47 and 60 were occupied in 1978. Other spring stations are from 1977. Summer stations were occupied in August 1978.

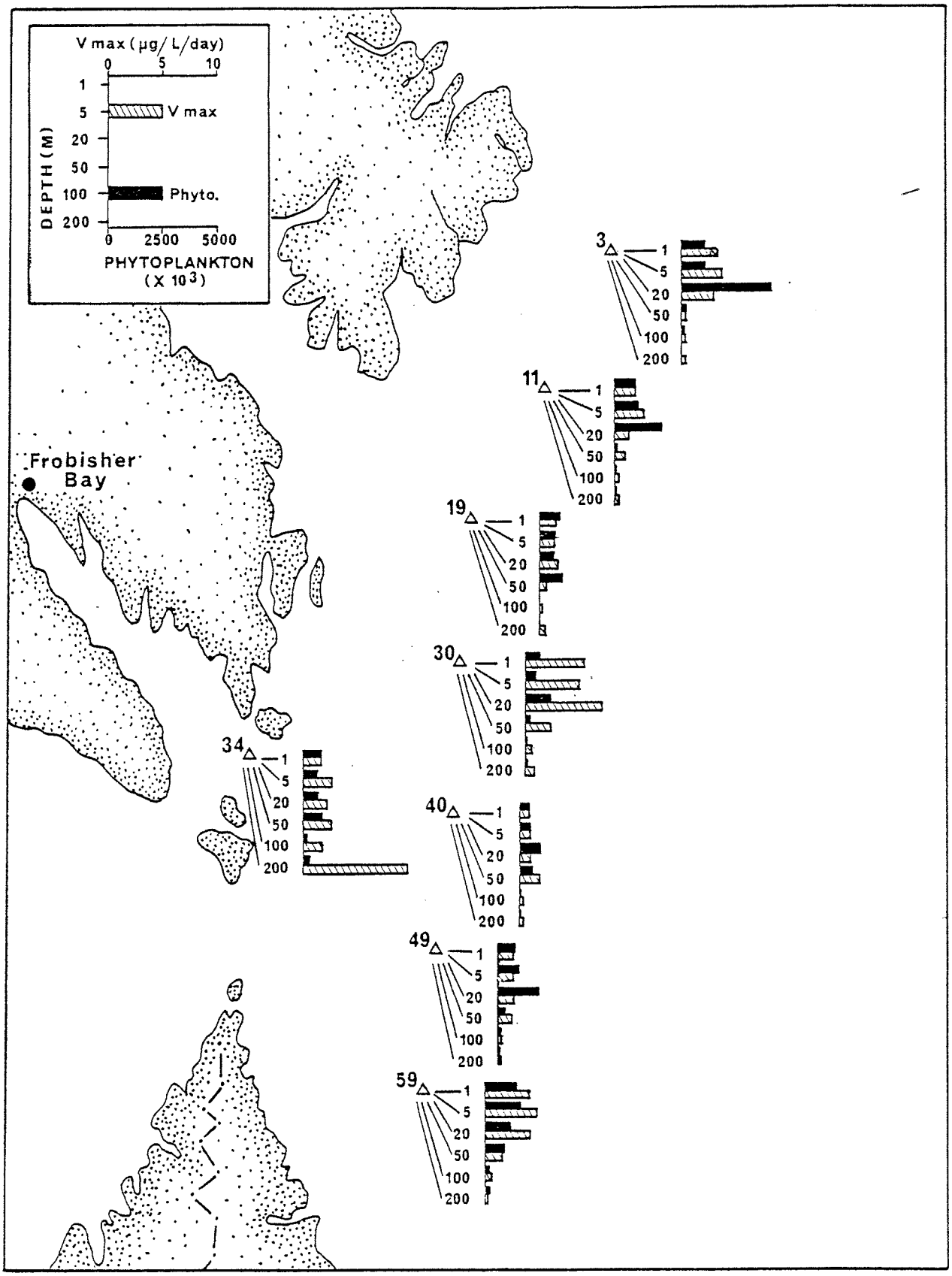

Figure 18. Comparison of numbers of phytoplankton and V max of bacteria in profiles at stations occupied in August 1978.

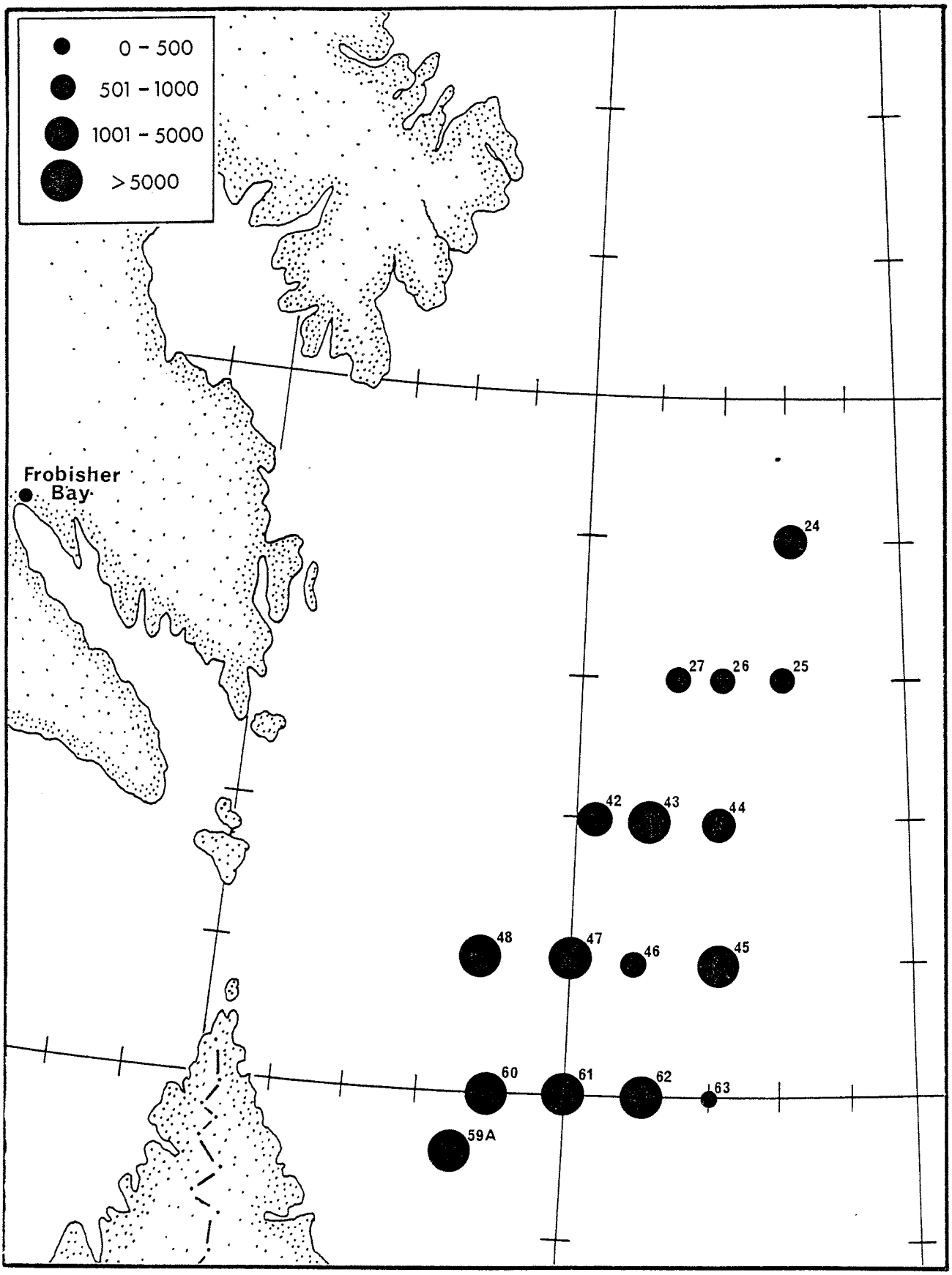

Figure 19. Average maximum hexadecane mineralization represented as disintegrations per minute (DPM) after sixteen days incubation of one metre water from stations occupied in Davis Strait during April 1978. DPM is expressed in four ranges represented by four sizes of circles.

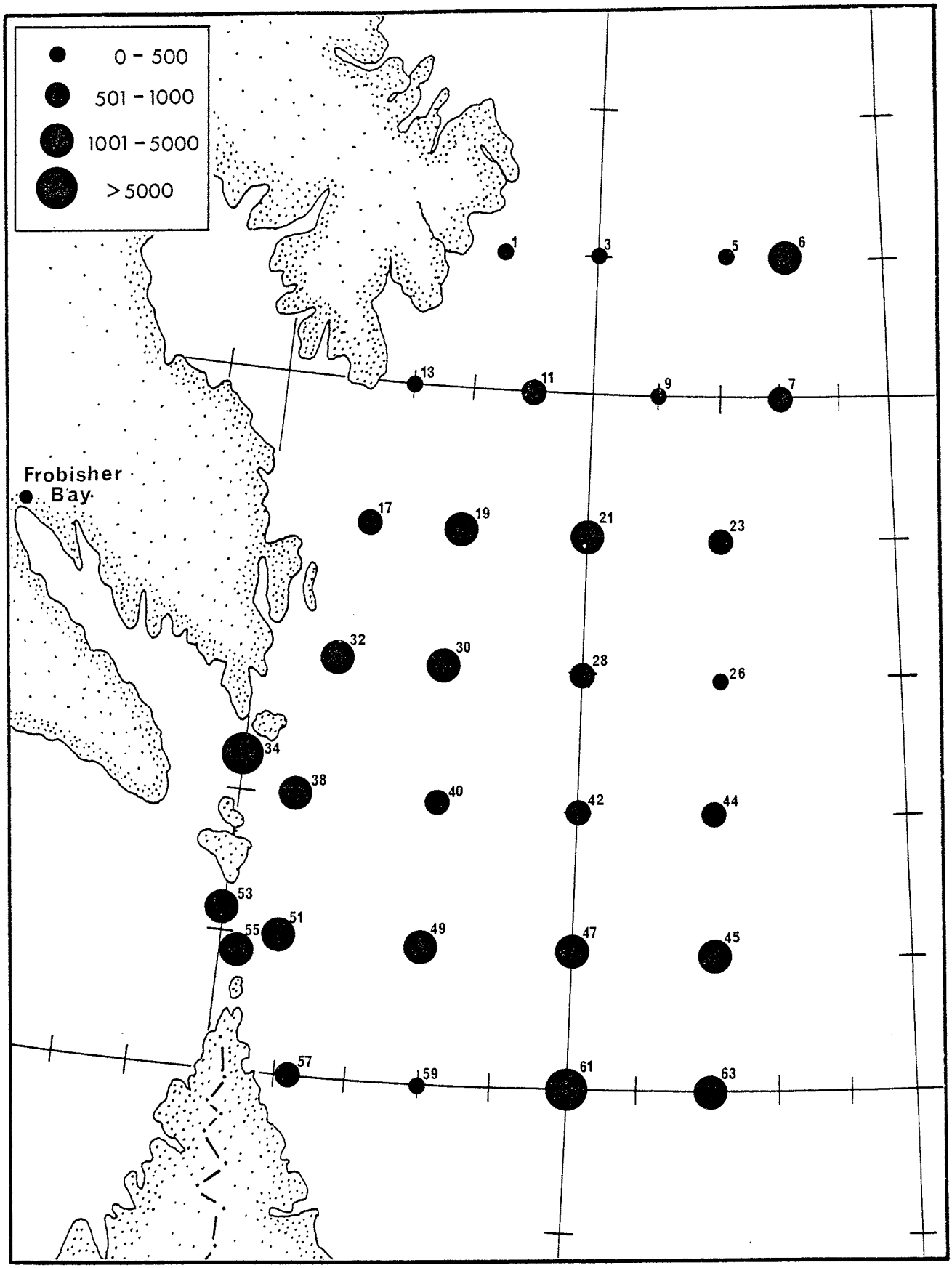

Figure 20. Average maximum hexadecane mineralization represented as disintegrations per minute (DPM) after fifteen days incubation of one metre water from stations occupied in Davis Strait during August 1978. DPM is expressed in four ranges represented by four sizes of circles.

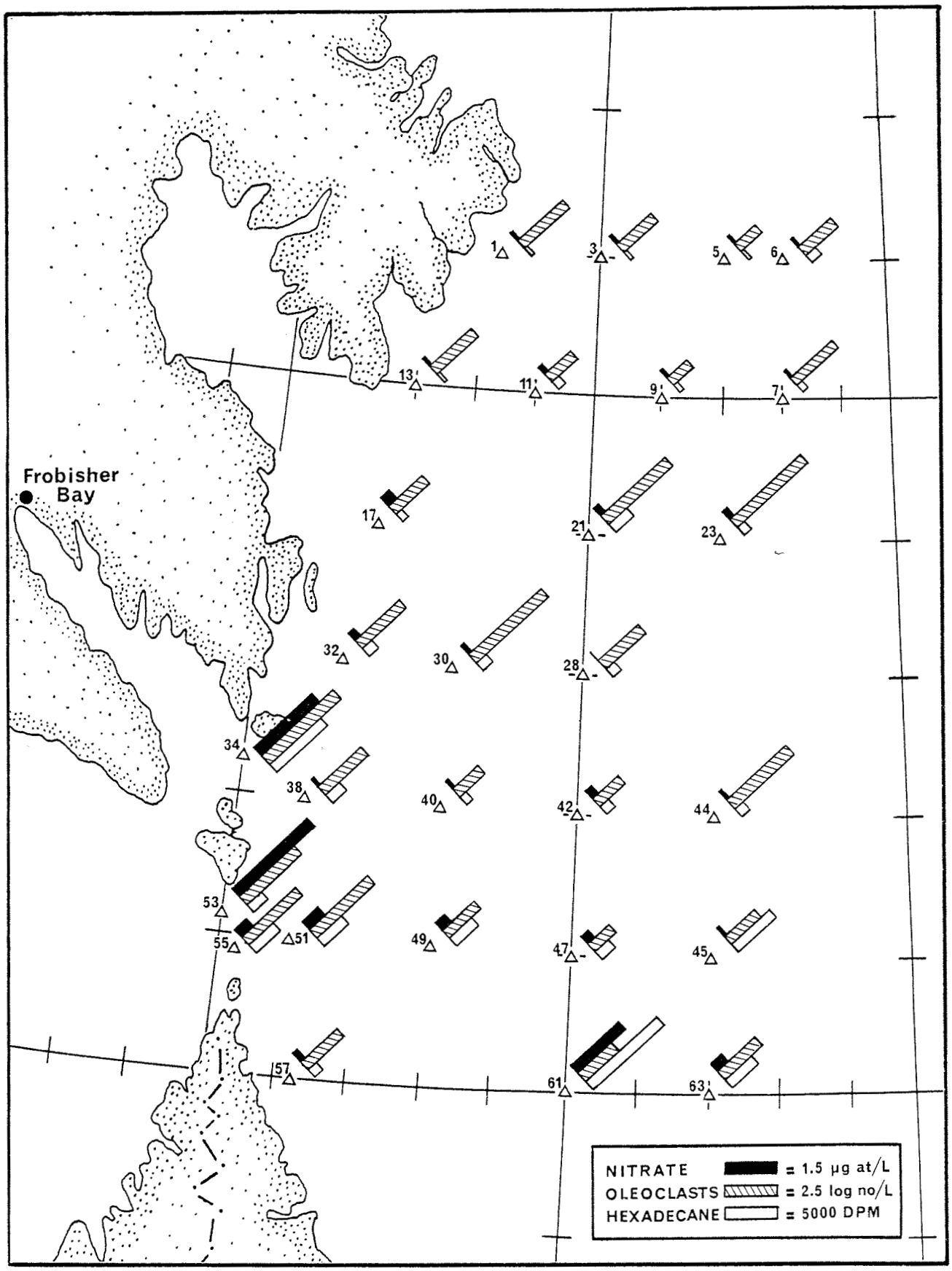

Figure 21. Comparison of reactive nitrate concentrations, numbers of oleoclasts and maximum DPM of hexadecane mineralization in one metre water at stations occupied in August 1978.

8.0 APPENDIX

Tables 1-18

Table 1

Microbiology Stations in Davis Strait

April-May 1977 Cruise 77-2

Stn. No.	Date	Position	
		Lat.	Long.
65	26 April	54°51'N	53°03'W
60	28 April	59°55'N	60°38'W
61	28 April	60°01'N	60°07'W
62	28 April	60°01'N	59°04'W
63	27 April	60°00'N	57°59'W
48	30 April	60°56'N	61°07'W
47	2 May	60°59'N	59°57'W
46	2 May	61°01'N	58°52'W
40	3 May	62°01'N	61°27'W
41	3 May	62°02'N	60°57'W
42	4 May	61°52'N	60°04'W
43	5 May	62°01'N	58°58'W
44	5 May	61°59'N	58°02'W
30A	6 May	63°02'N	61°35'W
29	6 May	62°59'N	60°59'W
28	7 May	62°59'N	59°58'W
27	7 May	62°59'N	58°57'W
26	7 May	62°58'N	57°58'W
25	7 May	63°00'N	56°58'W

Table 2

Microbiology Stations in Davis Strait

April 1978 Cruise 78-1

Stn. No.	Date	Position	
		Lat.	Long.
55M	13 April	55°00'N	54°43'W
57M	14 April	57°08'N	56°39'W
58M	14 April	58°00'N	57°28'W
59M	14 April	58°58'N	58°24'W
59A	16 April	59°38'N	61°30'W
60	18 April	60°00'N	61°00'W
61	18 April	60°00'N	60°00'W
62	18 April	59°57'N	58°57'W
63	19 April	59°59'N	57°59'W
45	19 April	61°00'N	57°59'W
46	19 April	61°01'N	59°04'W
47	20 April	61°00'N	60°01'W
48	21 April	61°02'N	61°11'W
42	22 April	62°00'N	59°48'W
43	23 April	62°02'N	58°56'W
44	23 April	61°55'N	58°00'W
25	24 April	63°01'N	57°02'W
26	24 April	62°53'N	57°59'W
27	26 April	62°59'N	58°31'W
24	27 April	63°58'N	57°00'W

Table 3 (Continued)

August 1978 Cruise 78-2

Stn. No.	Date	Position	
		Lat.	Long.
7	20 Aug.	65°00'N	57°00'W
9	20 Aug.	65°00'N	58°59'W
11	20 Aug.	64°59'N	61°08'W
13	22 Aug.	65°00'N	63°00'W
6	21 Aug.	66°00'N	57°00'W
5	21 Aug.	66°02'N	58°07'W
3	21 Aug.	65°58'N	60°08'W
1	22 Aug.	66°00'N	61°36'W

Table 4

Abiotic Observations at Stations Occupied in Davis Strait

April-May 1977 Cruise 77-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 65						
0	-0.2	33.68	--	--	--	--
1	-- *	--	0.42	11.34	1.2	10
5	-0.2	33.70	0.52	8.11	--	--
20	-0.2	33.73	0.36	8.93	--	--
50	0.4	33.81	0.37	11.27	--	--
100	2.3	34.15	0.41	0.94	--	--
200	3.0	34.59	0.56	13.37	--	--
Stn. 60						
0	-0.7	33.66	--	--	--	--
1	--	--	0.36	4.98	1.4	190
5	-0.7	33.66	0.39	3.17	1.6	180
20	-0.4	33.73	0.33	4.76	1.5	90
50	-0.2	33.99	0.39	5.47	1.9	10
100	1.3	34.20	0.36	11.17	1.5	0
200	3.6	34.56	0.72	10.90	1.0	10
Stn. 61						
0	-0.5	--	--	--	--	--
1	--	33.66	0.25	7.28	1.6	170
5	-0.2	33.66	--	11.34	1.4	140
20	0.5	33.91	0.35	10.00	1.5	70
50	0.7	33.99	0.30	1.83	1.4	110
100	2.0	34.40	0.42	12.81	1.9	30
200	3.4	34.74	--	6.86	1.4	300
Stn. 62						
0	2.7	--	--	--	--	--
1	--	34.59	0.55	12.00	1.3	110
5	2.7	34.66	0.52	14.77	0.8	30
20	2.7	34.58	0.28	10.35	1.1	130
50	3.1	34.76	0.34	13.45	1.6	40
100	3.5	34.79	0.61	13.59	1.2	50
200	3.2	34.77	0.28	14.43	1.4	0

* no data

Table 4 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 63						
0	3.7	--	--	--	--	--
1	--	34.78	0.69	10.53	1.5	0
5	3.6	34.78	0.74	--	1.7	40
20	3.6	34.77	0.62	14.70	1.7	50
50	3.6	34.80	--	2.28	1.6	0
100	3.5	34.78	0.39	7.69	1.9	0
200	3.5	34.77	0.41	7.69	1.7	120
Stn. 48						
0	-1.4	--	--	--	--	--
1	--	33.50	0.32	5.58	1.8	460
5	-1.4	33.51	0.18	4.64	1.4	370
20	-1.2	33.82	0.36	8.13	1.6	270
50	1.6	34.09	0.52	8.80	1.6	20
100	2.4	34.41	0.56	7.81	2.4	0
200	3.9	34.63	0.42	11.75	1.4	60
Stn. 47						
0	3.2	34.69	--	--	--	--
1	--	--	0.41	9.71	1.5	160
5	3.2	34.71	0.36	--	1.3	170
20	3.2	34.69	0.38	4.68	1.9	120
50	3.3	34.72	0.38	13.42	1.6	200
100	3.4	34.73	0.58	5.67	1.4	130
200	3.4	34.77	0.52	18.83	1.5	130
Stn. 46						
0	3.3	34.73	--	--	--	--
1	--	--	0.36	10.03	1.3	120
5	3.2	34.74	0.71	10.30	1.7	40
20	3.2	34.73	0.53	11.23	1.5	80
50	3.2	34.75	0.39	11.81	--	--
100	3.2	34.74	0.58	10.99	1.2	50
200	3.4	34.78	0.52	18.62	1.2	40
Stn. 40						
0	-1.7	--	--	--	--	--
1	--	33.46	0.13	2.49	1.4	510
5	-1.7	33.45	0.18	1.76	1.2	400
20	-1.6	33.38	0.14	2.54	1.4	330
50	-0.4	33.81	0.37	8.44	1.4	80
100	1.8	34.08	0.24	16.97	1.3	10
200	3.5	34.62	0.47	9.66	1.9	40

Table 4 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 41						
0	-1.6	--	--	--	--	--
1	--	33.48	0.34	5.66	1.8	320
5	-1.6	33.46	0.38	4.71	3.0	250
20	-1.5	33.45	0.34	5.48	1.5	150
50	-1.9	33.49	0.54	5.90	1.2	130
100	0.6	34.06	0.64	9.52	0.9	0
200	3.0	34.56	0.54	12.63	1.8	0
Stn. 42						
0	0.6	--	--	--	--	--
1	--	33.94	0.20	4.64	1.8	670
5	0.7	33.89	0.22	2.07	1.7	510
20	1.4	34.00	0.20	2.69	1.9	740
50	2.1	34.25	0.20	7.13	--	440
100	3.0	34.60	0.56	7.08	1.6	80
200	3.7	34.78	0.68	6.46	1.3	80
Stn. 43						
0	3.2	34.66	--	--	--	--
1	--	--	0.50	6.37	1.3	120
5	3.2	34.67	0.50	8.50	1.3	80
20	3.2	34.66	0.42	8.62	1.6	170
50	3.3	34.75	0.48	8.68	1.2	80
100	3.4	34.80	0.42	8.16	1.3	20
200	3.5	34.81	0.38	11.63	1.5	10
Stn. 44						
0	3.3	--	--	--	--	--
1	--	34.54	0.31	3.32	1.4	230
5	3.2	34.55	0.27	3.69	--	--
20	3.2	34.56	0.23	4.72	1.6	160
50	3.4	34.72	0.44	8.31	1.6	10
100	3.5	34.84	0.37	8.74	1.8	30
200	3.5	34.78	0.44	9.43	1.3	10
Stn. 30A						
0	-1.7	--	--	--	--	--
1	--	33.21	0.28	3.19	2.6	100
5	-1.7	33.21	0.42	8.12	1.4	140
20	-1.7	33.22	0.26	1.68	1.7	100
50	-1.9	33.19	0.30	4.60	--	20
100	-1.4	33.48	0.42	4.14	2.6	110
200	1.0	33.98	0.44	5.36	1.8	230

Table 4 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 29						
0	-1.5	33.35	--	--	--	--
1	--	--	--	--	2.0	580
5	-1.5	33.34	0.15	0.19	1.5	770
20	-1.7	33.35	0.13	0.36	1.3	410
50	-1.6	33.49	0.42	5.36	3.1	320
100	1.1	34.02	0.69	10.26	1.9	280
200	3.9	34.61	0.46	8.39	1.3	170
Stn. 28						
0	-1.4	33.34	--	--	--	--
1	--	--	0.09	0.05	1.6	950
5	-1.4	33.36	0.06	0.08	1.6	800
20	-1.5	33.35	0.09	0.07	1.2	790
50	-0.9	33.60	0.44	7.55	1.3	60
100	1.8	34.11	0.39	9.27	1.4	50
200	4.0	34.65	0.48	12.50	1.3	190
Stn. 27						
0	0.8	33.93	--	--	--	--
1	--	--	0.08	0.05	1.3	570
5	0.8	33.93	0.06	0.07	1.8	580
20	0.8	33.95	0.08	0.17	1.8	590
50	1.9	34.29	0.37	7.80	1.8	160
100	3.5	34.60	0.60	21.31	1.6	40
200	4.1	34.80	0.68	12.29	1.4	10
Stn. 26						
0	0.2	30.61	--	--	--	--
1	--	--	0.68	0.32	1.4	790
5	0.2	33.60	0.08	0.02	1.4	860
20	1.2	33.76	0.20	3.31	1.8	480
50	2.4	34.20	0.50	11.47	1.7	60
100	3.5	34.47	0.56	12.77	1.4	120
200	4.2	34.75	0.68	12.66	--	20
Stn. 25						
0	1.6	--	--	--	--	--
1	--	33.95	0.16	1.58	1.4	550
5	1.6	33.96	0.17	1.63	1.8	560
20	1.5	33.95	0.20	1.56	1.2	480
50	2.1	34.26	0.68	4.33	1.6	40
100	3.2	34.52	0.68	7.93	1.1	0
200	4.1	34.78	0.67	13.18	1.2	30

Table 5

Abiotic Observations at Stations Occupied in Davis Strait

April 1978 Cruise 78-1

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 59A						
0	-2.0	31.89	--	--	--	--
1	--	--	0.64	11.14	1.6	120
5	-2.0	32.91	0.68	7.24	1.5	0
20	-1.9	32.92	0.94	9.27	1.6	190
50	-1.7	33.00	0.80	7.08	1.7	0
100	-0.9	33.32	0.78	6.84	1.9	40
200	--	--	--	--	1.4	0
Stn. 60						
0	0.0	33.88	--	--	--	--
1	--	--	0.69	8.37	1.5	0
5	0.0	33.87	0.58	10.39	1.6	0
20	0.0	33.89	0.64	10.22	1.9	0
50	0.0	33.90	0.62	8.12	2.3	0
100	3.3	34.17	0.14	11.17	1.9	0
200	3.8	34.67	0.79	--	1.1	70
Stn. 61						
0	0.0	34.16	0.44	--	--	--
1	--	--	--	--	2.8	20
5	0.0	34.07	0.66	10.38	1.7	300
20	0.0	34.12	0.56	10.33	12.2	30
50	0.1	34.10	0.19	0.32	--	0
100	3.4	34.57	0.78	12.37	1.8	60
200	3.9	34.85	0.83	13.37	1.3	--
Stn. 62						
0	2.0	34.55	0.76	--	--	--
1	--	--	--	--	--	20
5	1.8	34.51	0.76	12.01	1.7	--
20	1.7	34.50	0.44	12.89	1.9	--
50	1.7	34.51	0.77	11.34	1.8	--
100	1.7	34.61	0.78	13.50	1.5	0
200	2.9	34.76	0.74	14.57	5.1	0

Table 5 (Continued)

April 1978 Cruise 78-1

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 63						
0	1.5	34.55	--	10.30	--	--
1	--	--	--	--	2.2	0
5	1.5	34.46	0.82	11.56	1.4	0
20	1.5	34.47	0.75	13.56	1.3	--
50	1.6	34.54	0.83	13.50	1.8	50
100	2.7	34.65	0.76	14.11	1.8	0
200	3.8	34.85	0.90	13.03	1.8	80
Stn. 48						
0	-1.7	33.78	0.68	7.53	--	--
1	--	--	--	--	--	120
5	-1.7	33.75	0.69	10.54	1.1	90
20	--	33.75	0.63	11.35	1.3	90
50	-1.9	33.92	0.69	10.60	1.3	340
100	0.8	34.49	0.70	12.82	--	120
200	--	34.84	0.87	12.72	2.0	160
Stn. 47						
0	-1.8	33.77	0.18	--	--	--
1	--	--	--	--	0.2	290
5	-1.7	33.68	0.67	6.05	--	130
20	-1.4	33.68	0.58	10.75	--	50
50	-0.4	34.08	0.70	11.53	0.9	20
100	3.8	34.70	0.81	10.87	--	50
200	4.6	34.87	0.58	7.17	--	0
Stn. 46						
0	-0.2	34.21	0.71	--	--	--
1	--	--	--	--	2.0	480
5	-0.2	34.18	0.65	12.71	1.1	310
20	-0.3	34.18	0.68	7.52	--	1620
50	-0.3	34.51	--	12.51	0.8	260
100	2.0	34.76	--	14.44	0.9	120
200	--	--	0.18	9.35	1.0	170
Stn. 45						
0	0.7	34.26	0.58	10.05	--	--
1	--	--	--	--	2.5	40
5	0.7	34.27	0.65	10.25	1.5	0
20	0.6	34.26	0.69	12.22	2.2	130
50	0.5	34.29	0.73	10.86	1.0	210
100	3.2	34.71	0.86	11.60	--	10
200	3.4	34.77	0.84	13.29	1.5	60

Table 5 (Continued)

April 1978 Cruise 78-1

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 25						
0	-0.7	33.31	0.09	0.32	--	--
1	--	--	--	--	2.1	450
5	-0.8	33.29	0.11	0.08	2.1	690
20	-1.1	33.39	0.12	0.33	1.9	520
50	-1.4	33.41	0.44	5.34	1.4	0
100	0.6	33.99	0.79	9.94	1.8	110
200	4.0	34.73	0.76	11.64	2.9	90
Stn. 24						
0	--	--	0.24	3.66	--	--
1	--	--	--	--	0.6	4320
5	-1.7	33.39	0.31	--	1.7	230
20	-1.8	33.42	0.21	--	2.3	280
50	-1.8	33.41	0.29	--	1.5	40
100	1.0	34.00	0.72	--	1.4	0
200	--	34.65	0.76	--	1.4	40

Table 6

Abiotic Observations at Stations Occupied in Davis Strait

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 57						
1	1.6	31.79	0.23	0.15	2.0	360
5	1.6	31.79	0.18	0.25	1.4	300
20	0.8	32.00	0.38	1.61	1.4	120
50	0.5	32.23	0.57	3.87	1.6	110
100	0.2	32.60	0.71	6.40	1.3	70
140	--	--	0.73	6.92	1.6	90
Stn. 59						
1	1.0	32.06	0.26	0.26	1.4	200
5	1.0	32.06	0.27	0.41	1.8	270
20	0.8	32.34	0.32	0.96	1.9	340
50	-0.1	32.50	0.54	2.89	1.6	80
100	-0.2	32.81	0.81	7.20	1.5	40
140	-0.1	33.14	0.72	6.86	1.4	90
Stn. 61						
1	3.4	33.38	0.23	1.84	2.3	120
5	3.5	33.31	0.19	2.00	1.2	110
20	3.4	33.33	0.25	2.55	1.1	60
50	2.8	33.63	0.44	5.93	1.6	--
100	2.7	34.32	0.75	11.50	1.1	0
200	--	--	0.91	12.95	1.1	0
Stn. 63						
1	5.2	33.58	0.15	0.36	1.5	60
5	5.2	33.58	0.14	0.35	1.6	50
20	5.2	33.58	0.18	1.45	1.8	20
50	2.0	34.04	0.36	3.43	1.4	30
100	4.0	34.68	0.75	12.91	1.2	20
200	4.0	34.77	0.96	10.43	1.4	30
Stn. 53						
1	1.1	32.98	0.51	2.90	1.5	210
5	1.0	33.01	0.43	2.73	1.6	150
20	1.0	33.00	0.56	3.80	1.5	210
50	0.0	33.17	0.57	4.76	1.5	170
100	-0.1	33.49	0.73	7.07	1.4	110
200	0.1	33.96	0.78	10.77	1.5	60

Table 6 (Continued)

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 34						
1	0.7	33.03	0.59	2.21	1.7	120
5	0.5	33.05	0.62	2.48	2.0	120
20	0.1	33.10	0.59	2.43	1.6	110
50	0.0	33.11	0.97	2.90	1.8	100
100	-0.2	33.17	0.76	4.89	2.0	80
177	-0.1	33.52	--	--	--	--
200	--	--	0.76	7.82	2.0	500
Stn. 38						
1	3.6	32.46	0.35	0.03	1.9	90
5	3.5	32.47	0.32	0.13	1.4	100
20	2.2	32.69	0.37	0.45	1.8	150
50	-1.3	33.39	0.71	6.62	1.1	20
100	-1.4	33.52	0.77	10.45	1.0	0
200	1.3	34.09	0.81	11.00	1.9	0
Stn. 40						
1	3.9	32.49	0.24	0.14	1.4	60
5	3.8	32.49	0.26	0.26	1.9	100
20	2.4	32.74	0.24	0.20	1.7	60
50	-0.6	33.44	0.45	3.13	1.7	50
100	0.2	33.76	0.71	11.09	1.1	0
200	3.5	34.47	0.83	14.19	1.3	0
Stn. 42						
1	4.8	32.91	0.11	0.18	1.5	80
5	4.8	32.91	0.13	0.26	1.3	30
20	4.2	33.01	0.13	0.20	1.5	50
50	0.8	33.60	0.58	3.13	1.1	40
100	1.6	34.05	0.73	11.09	1.4	50
200	4.4	34.68	0.83	14.19	1.4	50
Stn. 44						
1	5.6	33.13	0.10	0.03	2.0	70
5	5.6	33.13	0.10	0.18	1.6	60
20	5.6	33.13	0.10	0.19	1.4	70
50	1.8	33.74	0.49	7.05	1.2	60
100	2.9	34.36	0.90	13.18	1.0	80
200	4.3	34.77	0.89	15.42	1.3	30

Table 6 (Continued)

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 32						
1	3.2	32.84	0.45	0.24	1.6	90
5	3.0	32.87	0.44	0.16	1.4	110
20	1.3	33.05	0.65	2.19	1.6	110
50	-0.1	33.13	0.74	4.02	1.8	30
100	-1.1	33.18	0.78	--	1.6	0
120	--	--	0.89	7.07	1.2	0
Stn. 30						
1	3.5	32.37	0.33	0.17	1.2	100
5	3.3	32.41	0.35	0.12	1.7	100
20	-0.6	33.04	0.80	3.58	1.8	150
50	-0.9	33.15	0.80	6.17	1.5	30
100	-1.3	33.28	0.91	9.66	1.8	0
200	-0.5	33.81	0.89	9.46	1.2	0
Stn. 28						
1	5.2	33.03	0.09	0.00	1.6	180
5	5.2	33.03	0.11	0.03	1.5	50
20	4.8	33.04	0.10	0.03	1.6	100
50	0.7	33.55	0.41	5.75	1.5	160
100	0.8	33.87	0.78	12.35	1.2	20
200	4.2	34.63	0.91	17.12	1.3	0
Stn. 26						
1	5.7	33.10	0.20	0.23	1.7	80
5	5.7	33.10	0.10	0.11	1.8	60
20	5.3	33.14	0.07	0.12	1.3	50
50	1.4	33.92	0.72	9.80	1.4	10
100	3.6	34.44	0.88	11.64	1.7	0
200	4.8	34.75	0.88	14.17	2.1	0
Stn. 17						
1	3.5	31.83	0.35	0.39	1.7	70
5	3.3	31.84	0.35	0.29	1.6	30
20	0.3	32.59	0.36	0.64	1.9	70
50	-0.7	32.84	0.69	6.14	1.5	20
100	-1.4	33.06	0.86	5.72	1.7	0
200	-0.8	33.50	0.92	10.61	1.4	10

Table 6 (Continued)

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 19						
1	4.2	31.94	0.38	0.10	1.3	10
5	4.2	31.95	0.36	0.06	1.6	70
20	-0.4	32.92	0.36	0.10	1.8	130
50	-1.6	33.23	--	0.80	1.8	0
100	-1.6	33.46	0.89	5.05	1.5	0
150	-1.0	33.73	0.87	5.03	1.6	0
Stn. 21						
1	4.4	31.93	0.42	0.22	2.1	100
5	4.4	32.17	0.47	0.15	1.5	60
20	-0.7	32.96	0.42	0.31	1.4	0
50	-1.3	33.36	0.74	5.58	1.4	0
100	-1.7	33.51	0.83	10.31	1.5	40
200	0.1	33.95	0.97	12.85	1.5	80
Stn. 23						
1	--	--	0.22	0.19	1.9	40
5	4.40	32.17	0.26	0.12	1.8	30
20	-0.73	32.96	0.12	0.15	1.7	90
50	-1.32	33.36	0.40	3.23	1.3	50
100	-1.68	33.51	0.69	8.34	2.2	0
200	0.08	33.95	0.88	13.70	1.3	50
Stn. 13						
1	--	--	0.32	0.05	2.7	130
5	2.13	31.84	0.28	0.18	1.4	150
20	1.15	32.01	0.35	0.11	1.3	259
50	-1.08	32.81	0.68	4.0	1.2	180
100	-1.65	33.22	0.95	6.7	1.5	50
140	--	--	0.82	9.10	1.8	0
Stn. 11						
1	--	--	0.47	0.22	1.4	50
5	4.16	31.93	0.45	0.13	1.6	20
20	-0.25	32.71	0.69	1.46	2.0	90
50	-1.60	33.18	0.90	4.67	1.8	0
100	-1.67	33.40	0.81	7.56	1.6	10
200	--	--	0.95	10.54	1.7	0

Table 6 (Continued)

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 9						
1	--	--	0.44	0.06	1.7	60
5	3.61	32.20	0.41	0.12	1.7	40
20	1.55	32.38	0.48	0.12	2.5	50
50	-1.51	33.37	0.78	6.29	1.7	50
100	-1.63	33.55	0.78	6.25	1.2	20
200	0.24	33.98	0.93	11.37	1.3	0
Stn. 7						
1	--	--	0.18	0.15	1.6	90
5	4.24	32.47	0.15	0.15	1.5	50
20	3.66	32.59	0.17	4.61	1.7	50
50	-1.20	33.47	0.49	4.71	1.6	60
100	-0.87	33.69	0.86	12.78	1.3	20
200	--	--	0.65	10.79	1.4	30
Stn. 1						
1	--	--	0.35	0.03	1.5	230
5	1.20	32.17	0.34	0.03	1.8	230
20	0.27	32.46	0.45	0.26	1.8	160
50	-0.96	32.88	0.73	4.75	1.2	100
100	-1.42	33.09	0.91	7.77	1.5	0
200	--	--	0.96	10.45	1.7	0
Stn. 3						
1	--	--	0.42	0.12	1.6	200
5	2.14	31.90	0.41	0.07	1.8	220
20	-0.81	32.79	0.52	0.14	1.9	350
50	-1.47	33.27	0.44	6.68	1.7	80
100	-1.61	33.51	0.92	5.27	1.6	20
200	-0.58	33.89	0.92	13.39	2.3	60
Stn. 5						
1	--	--	0.47	0.17	1.7	80
5	2.76	32.24	0.50	0.26	2.1	80
20	-0.11	32.83	0.50	0.06	1.7	80
50	-1.56	33.20	0.80	5.70	1.3	50
100	-1.57	33.51	0.91	5.62	1.6	0
200	0.95	34.06	1.01	10.94	1.5	0

Table 6 (Continued)

August 1978 Cruise 78-2

Depth (m)	Temp. (°C)	Salinity (°/₀₀)	Phosphate (µg at/L)	Nitrate (µg at/L)	DOC (mg/L)	POC (µg/L)
Stn. 6						
1	--	--	0.14	0.08	2.2	20
5	--	--	0.12	0.08	1.6	0
20	4.08	32.67	0.14	0.11	1.4	30
50	0.18	33.37	0.11	0.24	1.5	380
100	-0.54	33.71	0.61	7.76	1.1	50
200	2.48	34.25	0.88	9.80	1.3	0

Table 7

Observations of Chlorophyll a and Phytoplankton at Stations Occupied in Davis Strait.

April-May 1977 Cruise 77-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)
Stn. 65		
0	258 760	--
1	--	0.20
5	475 310	0.20
20	333 640	0.08
50	13 580	0.27
100	320	0.03
200	--	0.02
Stn. 60		
0	--	--
1	680 960	--
5	638 400	5.13
20	210 120	3.81
50	62 560	0.64
100	28 560	0.35
200	12 920	0.09
Stn. 61		
0	--	--
1	130 560	2.35
5	--	1.66
20	--	1.23
50	--	2.78
100	--	0.26
200	--	0.06
Stn. 62		
0	--	--
1	6 970	0.18
5	12 920	0.20
20	6 800	0.64
50	6 540	0.09
100	4 510	0.15
200	4 420	0.23

Table 7 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)
Stn. 63		
0	--	--
1	6 650	0.22
5	--	1.82
20	--	--
50	--	0.14
100	--	0.14
200	--	0.06
Stn. 48		
0	500 100	--
1	--	7.53
5	611 480	8.27
20	334 370	3.31
50	16 870	0.80
100	1 320	0.02
200	206 650	0.02
Stn. 47		
0	--	--
1	114 240	1.49
5	--	1.10
20	--	1.26
50	--	0.43
100	--	0.22
200	--	0.05
Stn. 46		
0	--	--
1	40 790	0.20
5	5 120	0.24
20	--	0.15
50	--	0.30
100	--	0.12
200	--	0.09
Stn. 40		
0	--	--
1	537 760	0.09
5	--	9.64
20	--	11.11
50	--	1.12
100	--	0.11
200	--	0.02

Table 7 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)
Stn. 41		
0	--	--
1	194 300	4.73
5	285 940	4.87
20	237 660	4.37
50	209 150	6.62
100	4 390	0.06
200	29 260	0.51
Stn. 42		
0	--	--
1	762 700	7.35
5	--	10.10
20	--	9.09
50	--	5.33
100	--	0.92
200	--	0.05
Stn. 43		
0	--	--
1	140 630	1.29
5	--	1.24
20	--	1.33
50	--	0.35
100	--	0.06
200	--	0.04
Stn. 44		
0	--	--
1	231 200	3.34
5	--	2.48
20	--	0.99
50	--	0.20
100	--	0.02
200	--	0.04
Stn. 30A		
0	--	--
1	82 460	0.21
5	53 200	0.03
20	85 120	0.27
50	53 200	0.02
100	7 980	0.13
200	9 310	0.01

Table 7 (Continued)

April-May 1977 Cruise 77-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)
Stn. 29		
0	--	--
1	1 077 300	1.93
5	3 278 500	13.87
20	--	11.76
50	--	0.14
100	--	0.10
200	--	0.04
Stn. 28		
0	--	--
1	913 560	24.91
5	--	6.52
20	--	14.97
50	--	0.19
100	--	0.07
200	--	0.02
Stn. 27		
0	585 280	--
1	--	13.59
5	836 500	17.18
20	709 500	0.11
50	243 070	2.42
100	940	0.03
200	--	0.22
Stn. 26		
0	--	--
1	2 415 280	5.33
5	--	0.14
20	--	0.09
50	--	0.13
100	--	0.21
200	--	0.17
Stn. 25		
0	--	--
1	1 787 520	11.94
5	--	12.86
20	--	0.11
50	--	0.74
100	--	0.09
200	--	0.30

Table 8

Observations of Chlorophyll a, Phytoplankton and Direct Count of Bacteria at Stations Occupied in Davis Strait.

April 1978 Cruise 78-1

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 59A			
0	307 030	0.51	--
1	--	--	7.92
5	96 030	0.07	7.68
20	267 760	0.06	7.81
50	21 280	0.05	7.63
100	80 010	0.08	7.45
200	37 320	--	7.34
Stn. 60			
0	18 269	0.06	--
1	--	--	8.21
5	82 160	0.13	8.28
20	25 417	0.16	8.05
50	9 267	0.14	7.65
100	16 415	0.14	7.31
200	530	0.04	7.18
Stn. 61			
0	45 842	0.18	--
1	--	--	8.31
5	90 446	0.19	8.12
20	34 088	0.21	7.81
50	30 573	0.21	7.72
100	7 943	0.06	7.32
200	1 853	0.04	7.25
Stn. 62			
0	33 799	0.13	--
1	--	--	8.27
5	74 480	0.13	8.05
20	26 925	0.13	7.43
50	4 766	0.13	7.38
100	12 709	0.13	7.23
200	1 324	0.03	6.90

Table 8 (Continued)

April 1978 Cruise 78-1

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 63			
0	77 290	0.18	--
1	--	--	8.25
5	74 480	0.18	8.05
20	91 040	0.15	7.69
50	133 090	--	7.54
100	50 050	0.05	7.22
200	33 260	0.03	7.03
Stn. 48			
0	63 543	0.05	--
1	--	--	8.42
5	258 910	0.22	8.17
20	35 570	0.13	7.90
50	7 943	0.13	7.77
100	4 236	0.00	7.45
200	1 059	0.03	7.15
Stn. 47			
0	34 813	0.24	--
1	--	--	8.34
5	412 300	0.30	8.19
20	48 620	0.34	7.79
50	12 709	0.08	7.69
100	265	0.01	7.16
200	--	0.29	6.87
Stn. 46			
0	--	0.31	--
1	--	--	8.46
5	207 300	0.34	8.31
20	75 096	0.48	8.03
50	19 857	0.32	7.73
100	--	0.14	7.40
200	--	0.07	7.13
Stn. 45			
0	97 605	0.68	--
1	--	--	8.32
5	715 870	0.50	8.11
20	30 387	0.59	8.16
50	--	0.85	7.87
100	5 944	0.25	7.34
200	594	0.05	6.93

Table 8 (Continued)

April 1978 Cruise 78-1

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 42			
0	283 920	0.22	--
1	--	--	8.28
5	226 100	0.23	8.28
20	220 940	0.28	8.04
50	267 720	0.23	7.81
100	77 140	0.13	7.30
200	34 580	0.06	6.98
Stn. 43			
0	21 975	2.34	--
1	--	--	8.53
5	218 030	3.50	8.44
20	124 817	2.20	8.14
50	66 830	1.10	7.88
100	1 853	0.10	7.44
200	1 853	0.03	7.07
Stn. 44			
0	321 970	0.57	--
1	--	--	8.26
5	218 030	1.71	8.29
20	2 465 900	6.89	7.87
50	125 020	0.22	7.98
100	13 300	0.03	7.46
200	26 600	0.04	7.21
Stn. 27			
0	2 521 070	9.24	--
1	--	--	8.56
5	2 103 160	10.10	8.50
20	432 887	10.44	8.26
50	846 711	5.34	8.21
100	6 619	0.28	7.83
200	1 324	0.09	7.15
Stn. 26			
0	4 076 286	11.75	--
1	--	--	8.55
5	2 988 560	16.44	8.57
20	3 818 937	19.10	8.43
50	154 525	0.01	8.20
100	3 707	0.01	7.67
200	3 177	0.06	7.51

Table 9

Observations of Chlorophyll a, Phytoplankton and Direct Count of Bacteria at Stations Occupied in Davis Strait.

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 57			
1	508 000	0.33	8.68
5	481 000	0.41	8.63
20	426 000	0.44	8.37
50	737 000	0.45	8.25
100	401 000	0.39	7.92
200	439 000	0.40	8.01
Stn. 59			
1	1 198 000	1.65	8.53
5	1 472 000	1.55	8.46
20	835 000	0.91	8.48
50	649 000	--	8.40
100	279 000	0.24	7.92
200	314 000	0.12	7.77
Stn. 61			
1	894 000	0.70	8.46
5	580 000	0.77	8.52
20	399 000	0.67	7.90
50	57 000	0.18	8.18
100	26 000	0.05	7.77
200	17 000	0.41	7.66
Stn. 63			
1	201 000	--	--
5	209 000	0.13	--
20	178 000	0.13	--
50	279 000	0.61	--
100	19 000	0.01	--
200	13 000	0.01	--
Stn. 53			
1	309 000	0.66	8.76
5	351 000	0.67	8.67
20	536 000	0.65	8.24
50	190 000	0.68	8.24
100	76 000	--	8.08
200	160 000	0.06	7.74

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 55			
1	540 000	1.14	8.54
5	739 000	1.47	8.47
20	439 000	1.09	8.54
50	293 000	0.69	8.49
100	258 000	0.41	7.99
200	104 000	0.11	7.76
Stn. 51			
1	798 000	0.99	8.70
5	1 369 000	1.72	8.74
20	998 000	0.97	8.55
50	386 000	0.42	8.29
100	124 000	0.26	7.97
200	67 000	0.60	7.97
Stn. 49			
1	620 000	0.57	8.84
5	851 000	0.56	8.26
20	1 708 000	0.52	8.07
50	133 000	0.17	8.39
100	17 000	0.03	8.00
200	13 000	0.01	7.96
Stn. 47			
1	657 000	0.18	8.72
5	902 000	0.19	8.79
20	819 000	0.19	8.71
50	1 008 000	0.69	8.14
100	36 000	0.01	7.95
200	13 000	0.01	7.65
Stn. 45			
1	466 000	0.17	8.69
5	511 000	0.17	8.69
20	207 000	0.16	8.40
50	149 000	0.74	7.93
100	20 000	0.01	7.65
200	9 000	0.01	7.83

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 34			
1	747 000	0.58	8.44
5	455 000	0.58	8.45
20	503 000	0.55	8.48
50	694 000	0.58	8.55
100	133 000	0.34	8.17
200	250 000	0.48	7.95
Stn. 38			
1	330 000	0.19	8.76
5	298 000	0.30	8.58
20	551 000	--	8.81
50	57 000	0.09	8.27
100	16 000	0.03	8.04
200	37 000	0.01	7.26
Stn. 40			
1	314 000	0.09	8.62
5	479 000	0.10	8.31
20	558 000	0.12	8.33
50	346 000	0.58	8.29
100	15 000	0.02	7.92
200	7 000	0.01	7.79
Stn. 42			
1	166 000	0.12	8.71
5	249 000	0.10	8.28
20	267 000	0.13	8.08
50	47 000	0.08	7.89
100	21 000	0.04	7.80
200	21 000	0.01	7.53
Stn. 44			
1	130 000	0.09	8.66
5	274 000	0.10	8.33
20	198 000	0.09	8.24
50	207 000	0.45	8.08
100	7 000	0.01	7.78
200	5 000	0.01	7.44

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 32			
1	638 000	0.17	8.79
5	623 000	0.26	8.68
20	753 000	0.53	8.54
50	94 000	0.15	8.38
100	31 000	0.15	8.11
200	44 000	0.28	8.16
Stn. 30			
1	370 000	0.07	8.52
5	391 000	0.09	8.53
20	817 000	1.00	8.59
50	129 000	0.40	8.40
100	89 000	0.09	8.07
200	25 000	--	7.91
Stn. 28			
1	838 000	0.17	8.76
5	473 000	0.15	8.70
20	604 000	0.19	8.50
50	287 000	1.74	8.38
100	24 000	0.01	7.99
200	8 000	0.01	7.91
Stn. 26			
1	423 000	0.09	8.60
5	418 000	0.08	8.39
20	364 000	0.10	8.14
50	16 000	0.02	8.11
100	20 000	--	7.87
200	29 000	--	7.50
Stn. 17			
1	408 000	0.11	8.63
5	353 000	0.10	8.33
20	337 000	0.58	8.61
50	106 000	0.27	8.28
100	32 000	0.07	8.07
200	23 000	0.01	7.95

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 19			
1	777 000	0.09	8.49
5	575 000	0.10	8.44
20	548 000	0.08	8.46
50	944 000	1.52	8.09
100	27 000	0.05	7.76
200	7 000	0.01	7.58
Stn. 21			
1	694 000	0.09	8.53
5	641 000	--	8.53
20	1 713 000	0.62	8.20
50	60 000	0.09	8.32
100	24 000	0.02	7.62
200	9 000	0.24	7.64
Stn. 23			
1	354 000	0.15	8.63
5	489 000	0.10	8.67
20	279 000	0.08	8.34
50	106 000	0.79	8.27
100	27 000	0.03	8.11
200	17 000	0.01	7.74
Stn. 13			
1	521 000	0.44	8.74
5	1 118 000	0.55	8.39
20	1 107 000	1.40	8.02
50	673 000	0.85	8.30
100	69 000	0.04	7.89
200	49 000	0.06	7.70
Stn. 11			
1	866 000	0.09	8.98
5	814 000	0.09	8.62
20	2 181 000	0.04	8.38
50	69 000	0.09	8.33
100	33 000	--	7.97
200	37 000	0.02	7.69

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 9			
1	231 000	--	8.90
5	223 000	0.05	8.90
20	451 000	0.07	8.85
50	145 000	0.46	8.46
100	29 000	0.06	--
200	16 000	--	8.00
Stn. 7			
1	290 000	0.09	8.29
5	279 000	0.09	7.96
20	330 000	0.08	8.14
50	162 000	0.16	7.99
100	37 000	0.06	7.60
200	37 000	0.05	7.66
Stn. 1			
1	2 402 000	1.04	8.46
5	2 857 000	1.31	8.29
20	1 870 000	1.84	8.32
50	1 273 000	1.16	8.04
100	481 000	0.28	7.69
200	142 000	0.11	7.67
Stn. 3			
1	1 107 000	0.12	8.57
5	1 140 000	0.14	8.60
20	4 293 000	1.47	8.23
50	166 000	0.21	8.08
100	113 000	0.52	7.97
200	25 000	0.03	7.86
Stn. 5			
1	1 170 000	0.16	9.11
5	787 000	0.11	8.96
20	825 000	0.11	8.58
50	1 557 000	0.41	8.40
100	55 000	0.05	8.00
200	20 000	0.06	7.68

Table 9 (Continued)

August 1978 Cruise 78-2

Depth (m)	Phytoplankton (no./L)	Chlorophyll a (mg/m^3)	Direct Count (log no./L)
Stn. 6			
1	497 000	0.12	8.42
5	359 000	0.12	8.19
20	309 000	0.12	7.96
50	1 487 000	0.11	8.35
100	45 000	0.05	7.73
200	21 000	0.01	7.72

Table 10

Total Viable Heterotrophs and Oleoclasts with Related Abiotic Observations in One Metre Water at Stations Occupied in Davis Strait

April-May 1977 Cruise 77-2

Stn. no.	Oleoclasts (log no./L)	TVH (log no./L)	Oleoclasts (%)	Phosphate (µg at/L)	Nitrate (µg at/L)
65	1.60	4.30	0.20	0.42	11.34
60	<1.48	4.18	<0.20	0.36	4.98
61	<1.48	4.07	<0.25	0.25	7.28
62	1.60	3.22	2.50	0.55	12.00
63	1.60	3.22	2.50	0.69	10.53
48	2.45	4.62	0.67	0.32	5.58
47	2.63	4.07	3.60	0.41	9.71
46	2.32	--	--	0.36	10.03
40	1.60	4.40	0.16	0.13	2.49
41	<1.48	4.07	<0.25	0.34	5.66
42	2.04	4.30	0.55	0.20	4.64
43	1.48	4.30	0.15	0.50	6.37
44	1.60	--	--	0.31	3.32
30 A	1.48	4.34	0.14	0.28	3.19
29	<1.48	4.22	<0.19	--	--
28	1.48	4.00	0.30	0.09	0.05
27	1.60	3.92	0.48	0.08	0.05
26	<1.48	3.52	<0.91	0.68	0.32
25	<1.48	--	--	0.16	1.58

Table 11

Total Viable Heterotrophs and Hexadecane Mineralization with Related Abiotic Observations in One Metre Water at Stations Occupied in Davis Strait.

April 1978 Cruise 78-1

Stn. no.	Hexadecane (Av. Max. DPM)	TVH (log no./L)	Phosphate (µg at/L)	Nitrate (µg at/L)
59A	11 542	4.64	0.64	11.14
60	11 421	4.40	0.69	8.37
61	16 801	4.58	0.44	--
62	33 874	--	0.76	--
63	353	--	--	10.30
48	27 938	3.22	0.68	7.53
47	23 258	4.00	0.18	--
46	634	3.92	0.71	--
45	62 324	3.52	0.58	10.05
42	1 287	5.00	0.60	7.10
43	23 348	4.78	0.66	7.65
44	1 797	3.70	0.30	10.62
27	593	4.50	0.20	2.80
26	567	5.52	0.12	0.27
25	773	5.66	0.09	0.32
24	1 673	4.74	0.24	3.66

Table 12

Total Viable Heterotrophs, Oleoclasts and Hexadecane Mineralization with Related Abiotic Observations in One Metre Water at Stations Occupied in Davis Strait.

August 1978 Cruise 78-2

Stn. no.	Hexadecane (Av.Max.DPM)	Oleoclasts (log no./L)	TVH (log no./L)	Oleoclasts (%)	Phosphate (µg at/L)	Nitrate (µg at/L)
57	874	2.32	5.85	0.03	0.23	0.15
59	0	2.88	5.76	0.13	0.26	0.26
61	8 493	2.04	5.55	0.03	0.23	1.84
63	3 069	2.15	5.92	0.02	0.15	0.36
53	1 553	3.38	5.81	0.37	0.51	2.90
55	3 039	3.32	6.06	0.18	0.40	0.46
51	2 790	3.66	6.33	0.21	0.28	0.55
49	2 630	1.95	4.96	0.10	0.16	0.43
47	1 644	1.30	6.14	<0.01	0.12	0.25
45	4 517	1.95	6.23	0.01	0.13	0.12
34	6 854	>4.38	4.40	>95.50	0.59	2.21
38	1 662	2.63	6.11	0.03	0.35	0.03
40	728	1.60	5.54	0.01	0.24	0.14
42	941	1.60	6.07	<0.01	0.11	0.18
44	685	3.66	6.08	0.38	0.10	0.03
32	1 093	2.81	6.45	0.02	0.45	0.24
30	1 051	>4.38	6.64	>0.55	0.33	0.17
28	903	2.45	5.84	0.04	0.09	0.00
26	390	--	5.61	--	0.20	0.23
17	886	2.18	5.86	0.02	0.35	0.39
19	1 327	--	6.46	--	0.38	0.10
21	2 135	4.04	6.30	0.55	0.42	0.22
23	951	>4.38	6.05	>2.14	0.22	0.19
13	170	2.63	6.47	0.01	0.32	0.05
11	899	1.60	5.89	0.01	0.47	0.22
9	500	1.30	5.93	<0.01	0.44	0.06
7	875	2.63	5.11	0.33	0.18	0.15

Table 12 (Continued)

August 1978

Cruise 78-2

Str. no.	Hexadecane (Av.Max.DPM)	Oleoclasts (log no./L)	TVH (log no./L)	Oleoclasts (%)	Phosphate (µg at/L)	Nitrate (µg at/L)
1	337	2.63	6.08	0.04	0.35	0.03
3	139	2.18	6.07	0.01	0.42	0.12
5	299	1.30	6.08	<0.01	0.47	0.17
6	1 163	1.95	5.69	0.02	0.14	0.08

Table 13

Kinetic Parameters of Microbial Activity Obtained from One Metre Water Sampled at Stations on Five Latitudes in Davis Strait.

April-May 1977 Cruise 77-2

	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r
Latitude 55°N				
Stn. 65	0.44	9.23	4.03	0.992
Transect on Latitude 60°N				
60	2.95	3.66	10.82	0.996
61	1.68	4.87	8.37	0.992
62	0.21	15.07	3.17	0.998
63	0.13	34.67	4.65	0.988
Transect on Latitude 61°N				
48	9.30	2.75	25.58	0.989
47	0.48	25.60	12.16	0.978
46	0.16	40.26	6.63	0.972
Transect on Latitude 62°N				
40	10.03	2.78	27.86	0.967
41	5.51	3.46	19.07	0.966
42	5.15	2.19	11.30	0.915
43	0.73	10.28	7.55	0.967
44	3.92	6.08	23.83	0.950
Transect on Latitude 63°N				
30A	0.47	17.52	7.86	0.980
29	4.67	2.36	11.01	0.958
28	3.88	1.18	4.57	0.995
27	6.03	1.40	8.47	0.982
26	2.15	3.96	8.51	0.977
25	3.77	2.47	9.33	0.940

Table 14

Kinetic Parameters of Microbial Activity Obtained from One Metre Water Sampled at Stations on Seven Latitudes in Davis Strait.

April 1978 Cruise 78-1

	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r
Latitude 57°N				
Stn. 57M	0.11	101.31	11.01	0.960
Latitude 58°N				
58M	0.209	49.12	10.23	0.891
Transect on Latitude 59°N				
59M	0.300	33.25	9.94	0.975
59A	0.240	15.46	3.73	0.988
Transect on Latitude 60°N				
60	0.460	11.41	5.29	0.989
61	0.562	11.75	6.61	0.990
62	0.372	13.00	4.84	0.975
63	0.45	12.63	5.67	0.994
Transect on Latitude 61°N				
48	0.70	9.52	6.66	0.960
47	0.672	20.91	14.06	0.967
46	- - - - - - rejected data - - - - - -			
45	0.590	10.41	6.14	0.957
Transect on Latitude 62°N				
42	1.35	9.53	13.29	0.975
43	2.07	9.81	20.35	0.960
44	0.667	6.14	4.10	0.996
Transect on Latitude 63°N				
27	- - - - - - rejected data - - - - - -			
26	8.551	1.12	9.61	0.966
26T	8.674	1.36	11.82	0.977
25	4.361	1.65	7.21	0.983
24	- - - - - - rejected data - - - - - -			

Table 15

Kinetic Parameters of Microbial Activity Obtained from One Metre Water Sampled at Stations on Seven Latitudes in Davis Strait.

August 1978 Cruise 78-2

	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r
Transect on Latitude 60°N				
Stn. 57	3.54	0.81	2.87	0.992
59	3.79	1.17	4.44	0.991
61	1.53	3.57	5.47	0.927
63	1.76	1.99	3.50	0.997
Transect on Latitude 61°N				
53	1.74	3.16	5.49	0.990
55	2.97	1.13	3.36	0.951
51	4.05	0.96	3.87	0.980
49	0.95	5.46	5.20	0.990
47	1.92	2.63	5.04	0.977
45	1.68	2.55	4.28	0.996
Transect on Latitude 62°N				
34	1.29	1.47	1.89	0.931
38	2.07	2.27	4.71	0.992
40	0.71	3.30	2.33	0.998
42	1.11	3.15	3.49	0.997
44	0.84	2.12	1.83	0.980
Transect on Latitude 63°N				
32	2.05	1.51	3.09	0.994
30	4.79	1.31	6.27	0.965
28	1.57	5.32	8.34	0.988
26	0.75	3.00	2.24	0.983
Transect on Latitude 64°N				
17	1.16	0.81	0.94	0.869
19	1.42	1.28	1.81	0.988
21	1.32	2.64	3.47	0.988
23	1.17	7.01	8.22	0.978

Table 15 (Continued)

August 1978 Cruise 78-2

	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r
Transect on Latitude 65°N				
Stn. 13	4.85	0.94	4.58	0.968
11	1.58	1.21	1.91	0.985
9	2.05	0.64	1.31	0.990
7	0.70	4.15	2.90	0.990
Transect on Latitude 66°N				
1	3.35	2.60	8.70	0.993
3	2.90	0.66	2.05	0.969
5	2.58	0.94	2.41	0.950
6	1.11	4.69	5.20	0.989

Table 16

Total Viable Heterotrophs and Kinetic Parameters of Microbial Activity from Profile Station Waters Sampled in Davis Strait.

April-May 1977 Cruise 77-2

Depth (m)	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r	TVH (log no./L)
Stn. 60					
1	2.95	3.66	10.82	0.996	4.18
5	3.56	3.93	13.99	0.993	3.52
20	1.84	6.25	11.52	0.988	--
50	0.40	10.21	4.13	0.997	3.22
100	0.31	23.62	7.28	0.968	--
200	0.12	45.62	5.67	0.993	3.52
Stn. 62					
1	0.21	15.07	3.17	0.998	3.22
5	no data				3.52
20	0.18	15.30	2.75	0.998	--
50	0.13	27.00	3.60	0.996	3.52
100	0.12	30.73	3.73	0.995	--
200	0.14	42.30	5.97	0.993	--
Stn. 48					
1	9.30	2.75	25.58	0.989	4.62
5	8.85	3.95	34.93	0.981	4.40
20	10.84	1.84	19.97	0.985	4.26
50	no data				--
100	no data				--
200	0.70	26.94	18.78	0.954	3.22
Stn. 41					
1	5.51	3.46	19.07	0.966	4.07
5	5.33	4.81	25.66	0.975	4.18
20	4.92	4.82	23.71	0.974	4.00
50	4.89	2.11	10.31	0.989	4.00
100	0.11	74.86	7.96	0.942	--
200	0.06	172.69	10.65	0.960	--
Stn. 30A					
1	0.47	17.52	7.86	0.980	4.34
5	0.59	21.72	12.74	0.977	3.92
20	0.45	14.84	6.73	0.985	4.07
50	0.35	10.33	3.58	0.989	3.22
100	0.11	92.71	10.24	0.980	3.92
200	0.10	85.57	8.32	0.920	--

Table 17

Total Viable Heterotrophs and Kinetic Parameters of Microbial Activity from Profile Station Waters Sampled in Davis Strait.

April 1978 Cruise 78-1

Depth (m)	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r	TVH (log no./L)
Stn. 60					
1	0.46	11.41	5.29	0.989	4.40
5	0.51	15.39	7.91	0.981	4.00
20	0.55	14.45	8.03	0.994	4.88
50	rejected data				4.54
100	0.49	12.86	6.26	0.994	4.50
200	0.22	93.47	20.30	0.953	0.0
Stn. 47					
1	0.67	20.91	14.06	0.967	4.00
5	0.43	5.16	2.24	0.999	4.00
20	0.58	12.14	6.99	0.989	3.22
50	0.47	25.03	11.62	0.986	3.82
100	0.14	56.56	7.72	0.966	4.00
200	rejected data				3.22
Stn. 43					
1	2.07	9.81	20.35	0.960	4.78
5	1.42	4.19	5.94	0.995	5.28
20	2.06	5.55	11.44	0.989	4.45
50	1.13	5.70	6.46	0.992	3.52
100	0.20	41.92	8.44	0.995	3.82
200	0.23	70.72	16.49	0.972	4.00
Stn. 25					
1	4.36	1.65	7.21	0.983	5.66
5	5.35	1.38	7.40	0.984	5.54
20	4.51	0.99	4.47	0.983	5.33
50	2.86	1.74	4.98	0.930	4.34
100	0.48	34.08	16.23	0.938	4.12
200	rejected data				3.22

Table 18

Total Viable Heterotrophs and Kinetic Parameters of Microbial Activity from Profile Station Waters Sampled in Davis Strait.

August 1978 Cruise 78-2

Depth (m)	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r	TVH (log no./L)
Stn. 34					
1	1.29	1.47	1.89	0.931	4.40
5	2.06	2.24	4.63	0.994	4.74
20	1.64	1.33	2.19	0.993	4.74
50	1.56	2.05	3.20	0.997	4.65
100	1.44	1.69	2.44	0.960	4.96
200	9.37	1.16	10.86	0.984	5.98
Stn. 59					
1	3.79	1.17	4.44	0.991	5.76
5	4.49	1.63	7.32	0.990	5.73
20	3.97	1.84	7.25	0.979	5.64
50	1.43	3.70	5.28	0.980	5.25
100	0.90	9.22	8.26	0.973	4.65
200	0.35	27.08	9.45	0.990	4.91
Stn. 49					
1	0.95	5.46	5.20	0.990	4.96
5	0.99	5.06	4.99	0.969	4.96
20	1.02	4.21	4.27	0.981	5.16
50	1.12	2.33	2.60	0.996	5.17
100	0.34	7.31	2.48	0.999	4.79
200	0.12	26.82	3.30	0.995	3.70
Stn. 40					
1	0.71	3.30	2.33	0.998	5.54
5	0.77	4.20	3.25	0.995	5.68
20	0.66	1.41	0.93	0.999	5.77
50	1.13	3.75	4.24	0.996	4.89
100	0.32	18.53	5.85	0.987	4.26
200	0.18	44.43	8.06	0.996	4.48
Stn. 30					
1	4.79	1.31	6.27	0.965	6.64
5	4.56	1.43	6.50	0.986	6.67
20	6.59	0.70	4.63	0.954	6.37
50	1.68	2.05	3.50	0.996	6.22
100	0.64	11.86	7.58	0.982	4.80
200	0.66	7.33	4.82	0.988	5.07

Table 18 (Continued)

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Depth (m)	V_{max} (µg/L/day)	T (days)	K+S (µg/L)	r	TVH (log no./L)
Stn. 19					
1	1.42	1.28	1.81	0.988	6.46
5	1.41	1.87	2.64	0.998	6.34
20	1.42	2.00	2.83	0.998	6.53
50	0.39	3.34	1.29	0.995	5.11
100	0.19	26.65	5.13	0.991	4.87
200	0.43	7.74	3.37	0.994	4.80
Stn. 11					
1	1.58	1.21	1.91	0.985	5.89
5	2.40	1.27	3.06	0.961	6.30
20	1.23	1.13	1.39	0.965	5.93
50	0.68	10.27	7.02	0.989	4.00
100	0.24	15.12	3.55	0.989	4.48
200	0.16	57.70	9.33	0.996	4.52
Stn. 3					
1	2.90	0.66	2.05	0.969	6.07
5	3.66	1.60	5.86	0.983	5.98
20	2.87	0.67	1.93	0.965	5.60
50	0.40	13.23	5.33	0.989	4.62
100	0.21	17.20	3.59	0.995	4.85
200	0.22	32.71	7.28	0.971	5.02